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by

Peter K. L. Ng and Shane T. Ahyong

The New Crustacean Amphipod Genus *Kapalana* from Australian Waters (Senticaudata, Ischyroceridae, Ischyrocerinae, Cerapodini)

by

Penelope B. Berents and J. K. Lowry

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Peter K. L. Ng orcid.org/0000-0001-5946-0608
Shane T. Ahyong orcid.org/0000-0002-2820-4158

New Species of Reef Spider Crabs of the Genus *Schizophroida* Sakai, 1933 (Crustacea: Brachyura: Majidae) from the Western Pacific

Peter K. L. Ng[1] and Shane T. Ahyong[2]*

[1] Lee Kong Chian Natural History Museum, Faculty of Science, National University of Singapore, 2 Conservatory Drive, Singapore 117377, Republic of Singapore

[2] Australian Museum Research Institute, Australian Museum, 1 William Street, Sydney NSW 2010, Australia, and School of Biological, Earth & Environmental Sciences, University of New South Wales NSW 2052, Australia

peterng@nus.edu.sg · shane.ahyong@austmus.gov.au

Abstract. Prior to the present study, the spider crab genus *Schizophroida* Sakai, 1933, included only the type species, *S. hilensis* Rathbun, 1906 (described from Hawaii but apparently wide-ranging in the western Pacific), and two other Pacific species, *S. simodaensis* Sakai, 1933 (Japan) and *S. moai* Ng & Boyko, 2017 (Easter Island). Outside of Hawaii, *S. hilensis* has been reported from the southwestern Pacific: Australia, New Zealand and New Caledonia. Review of the southwestern Pacific material showed that *Schizophroida* from Australia and New Zealand belongs to a separate species, and is described as new to science. The New Caledonian record is based on an incomplete juvenile female, which also appears to be new to science, but is not formally named pending collection of more complete specimens. A second new species of *Schizophroida* is also described from specimens collected from Taiwan and Guam. A key to the species of *Schizophroida* is provided.

Keywords. Decapoda; spider crab; Australia; Lord Howe Island; Taiwan; Guam; western Pacific

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The spider crab genus *Schizophroida* Sakai, 1933, was established for three Indo-West Pacific species: *Schizophrys hilensis* Rathbun, 1906 (Hawaii), *Schizophroida simodaensis* Sakai, 1933 (Japan), and *Schizophroida manazuruana* Sakai, 1933 (Japan). Sakai (1933) distinguished *Schizophroida* from *Schizophrys* White, 1848, by its members lacking an accessory spine on the rostral spines and the absence of an anterior accessory spine on the postorbital lobe. No type species of the genus was selected by Sakai (1933), with Griffin & Tranter (1986) subsequently selecting *S. hilensis* as the type species.

Ng & Boyko (2017) reviewed the taxonomy of *Schizophroida* and showed that some of the taxonomic characters used by previous workers (e.g., Rathbun, 1906; Sakai, 1933, 1938, 1976; Buitendijk, 1939; Takeda, 1977; Griffin & Tranter, 1986) are not reliable. Ng & Boyko (2017) observed that the relative length of the rostral spines varies to some degree, the smoothness of the carpus of the cheliped was associated with sex (fully grown males have a granulose carpus), and the proportions of the ambulatory legs were sexually dimorphic, being proportionally longer and more slender in males. Several new species-specific

* author for correspondence

characters were also identified, e.g., the proportional width of the supraorbital eave, carapace armature along the lateral margin, shape of the carapace spines, shape of the male pleon and structure of the male first gonopod. As a result, they synonymised *S. manazuruana* Sakai, 1933, under *S. simodaensis* Sakai, 1933, confirming what Griffin & Tranter (1986) had surmised from published accounts. Ng & Boyko (2017) described a new species from Easter Island, *S. moai*, but also indicated the presence of probable undescribed species from the northwestern (Guam and Taiwan) and southwestern Pacific (Australia, New Zealand and New Caledonia; Griffin & Tranter, 1986). The present paper addresses these remaining species of *Schizophroida*.

Material and methods

Material examined is deposited in the Australian Museum, Sydney (AM), Kanagawa Prefectural Museum, Odawara, Japan (KPM); Los Angeles County Museum, U.S.A. (LACM); Marine Invasives Taxonomic Service, National Institute of Water and Atmospheric Research, Wellington, New Zealand (NIWA (MITS)); National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A. (USNM); National Taiwan Ocean University, Keelung, Taiwan (NTOU); and Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum, National University of Singapore. Carapace length (cl) is the total length and includes the rostral spines; postrostral carapace length (pcl) is measured along the midline from the base of the rostral sinus to posterior margin of the carapace; carapace width (cw) is the greatest width excluding spines. Measurements are in millimetres (mm). The abbreviations G1 and G2 are for the male first and second gonopods, respectively. Following Griffin & Tranter (1986), we use the term rostral spines for the two slender processes projecting forwards from the carapace front, and interantennular spine for the short ventromedial projection arising from the interantennular septum. These three processes have also been termed pseudorostral and rostral spines (for the lateral and median spines respectively) (e.g., Ng & Richer de Forges, 2012). The homology of these three processes with respect to the rostrum of other decapods is presently uncertain. Whether only the median process or all three processes represent the "true" rostrum (i.e., the rostrum is trifid) requires further study.

Comparative material. ***Schizophroida hilensis* (Rathbun, 1906)** (all Hawaii): USNM 29794, lectotype male (cl 16.1 mm, pcl 13.0 mm, cw 9.1 mm), 2 paralectotype females (cl 19.4 mm, pcl 16.5 mm, cw 11.9 mm; cl 16.2 mm, cw 10.6 mm), Hilo, coll. H. Henslow; ZRC 2000.0417, 1 male (cl 18.5 mm, pcl 14.9 mm, cw 11.0 mm), Magic Island, Ala Moana, Waikiki, Honolulu, coll. P. K. L. Ng & S. H. Tan, 22 January 2000; ZRC 2000.0459, 1 male (cl 12.4 mm, pcl 10.1 mm, cw 7.3 mm), 1.2 m, on seaweed wall, Fort DeRussy, O'ahu, coll. D. Takaoka, 14 September 1998; ZRC 2000.0502, 1 male (cl 12.5 mm, pcl 9.6 mm, cw 6.8 mm), north of Mōkapu Peninsula, Moku Manu Island, O'ahu, coll. R. De Felice & S. Coles, 26 January 2000; AM P29816, 4 males (cl 9.3 mm, pcl 7.4 mm, cw 5.2 mm to cl 14.0 mm, pcl 11.4 mm, cw 8.3 mm), 1 ovigerous female (cl 19.1 mm, pcl 16.3 mm, cw 12.0 mm), 2 juvenile females (cl 10.6 mm, pcl 8.4 mm, cw 6.1 mm; cl 13.5 mm, pcl 11.1 mm, cw 8.0 mm), Waikiki, reef, under stones near shore, coll. M. Ward, 24–30 August 1927; AM P29822, 1 male (cl 17.0 mm, pcl 13.6 mm, cw 9.7 mm), 1 pre-spawning female (cl 19.3 mm, pcl 16.2 mm, cw 12.0 mm), Hawaii; AM P29823, 1 male (cl 15.8 mm, pcl 12.7 mm, cw 8.9 mm), 1 ovigerous female (cl 14.4 mm, pcl 12.2 mm, cw 9.3 mm), Hawaii; AM P80450, 1 juvenile female (cl 12.8, pcl 10.5 mm, cw 7.5 mm), Hilo, Big Island, 19.7°N 155.1°W, coll. Mortensen, 7 April 1914.

***Schizophroida simodaensis* Sakai, 1933** (all Japan): ZRC 2016.0154, 1 male (cl 28.6 mm, pcl 23.0 mm, cw 16.6 mm), Kii-Nagashima, Mie Prefecture, coll. M. Saba, 14 April 1977; ZRC 2008.0695, 1 female (damaged, pcl 36.3 mm, cw 24.6 mm), no precise locality; KPM-NH0124024, 1 male (cl 31.9 mm, cw 28.7 mm), Minabe, Wakayama Prefecture, Kishu-nada Sea, coll. 1972; KPM-NH0124036, 3 males (cl 34.5 mm, cw 19.6 mm; cl 34.5 mm, cw 20.7 mm; cl 36.6 mm, cw 22.2 mm), Minabe, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104058, 1 male (cl 36.3 mm, cw 21.5 mm), Minabe, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104064, 1 female (cl 30.9 mm, cw 20.3 mm), Minabe, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104086, 1 male (cl 34.5 mm, cw 20.5 mm), no precise locality, 7 May 1934; KPM-NH0104136, 1 male (cl 26.8 mm, cw 14.7 mm), Tosa Bay, 1967; KPM-NH0104141, 2 males (cl 30.0 mm, cw 17.0 mm; cl 32.7 mm, cw 29.0 mm), Tosa Bay; KPM-NH0104355, 1 male (cl 35.9 mm, cw 21.1 mm), 1 female (cl 30.2 mm, cw 19.5 mm), Minabe, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104367, 1 female (cl 26.8 mm, cw 17.7 mm), Minabe, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104447, 1 male (cl 27.9 mm, cw 16.0 mm), Minabe, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104472, 3 females (cl 23.9 mm, cw 15.4 mm; cl 25.7 mm, cw 16.7 mm; cl 25.0 mm, cw 17.5 mm), Minabe, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104486, 1 male (cl 27.6 mm, cw 16.1 mm), Kushimoto, Wakayama Prefecture; KPM-NH0104517, 1 female (cl 28.8 mm, cw17.5 mm), Shirahama, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104527, 1 female (cl 29.9 mm, cw 18.5 mm), Nada-cho, Gobo, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104562, 1 male (cl 36.5 mm, 21.8 mm), Hatsushima Islet, Sagami Bay, Atami, Shizuoka Prefecture; KPM-NH0104631, 1 male (cl 33.8 mm, cw 28.8 mm), Shirahama, Wakayama Prefecture, Kishu-nada Sea, April 1964; KPM-NH0104643, 1 male (cl 29.2 mm, cw 17.5 mm), Kushimoto, Wakayama Prefecture; KPM-NH0104684, 1 female (cl 26.5 mm, cw 16.4 mm), Nada-cho, Gobo, Wakayama Prefecture, Kishu-nada Sea; KPM-NH0104924, 1 male (cl 30.3 mm, cw 17.8 mm), Kii-Nagashima, Kihoku (= Kii-Nagashima), Mie Prefecture, Kumano-nada Sea.

***Schizophroida moai* Ng & Boyko, 2017** (all Easter Island): USNM 1253232, holotype male (cl 32.2 mm, cw 21.2 mm), Anakena, coll. C. B. Boyko & S. Reanier, 30 August 1999. Paratypes: ZRC 2016.0155, 1 ovigerous female (cl 29.8 mm, pcl 24.5 mm, c 18.5 mm), Anakena, coll. C. B. Boyko & S. Reanier, 30 August 1999; ZRC 2016.0156, 1 male (pcl 16.7 mm, c 12.6 mm), no precise locality, coll. L. H. DiSalvo, 1985; ZRC 2016.0157, 1 juvenile female (cl 13.1 mm, pcl 9.5 mm, cw 6.8 mm), no precise locality, coll. L. H. DiSalvo, 1985; LACM CR1999-1, 1 juvenile (cl 2.5 mm, cw 4.5 mm), no precise locality, coll. C. B. Boyko, August 1999; LACM CR1999-2, 1 juvenile (cl 1.9 mm, cw 2.8 mm), Ahu Tepeu, 15.2 m, coll. H. Tonnemacher, 29 August 1999.

***Schizophroida* sp.**: AM P29817, 1 juvenile female (cl 19.0 mm, pcl 15.2 mm, cw 10.4 mm), off New Caledonia, 22°48.5'S 167°36.5'E, 85–100 m, large bottom dredge, RV *Kimbla* K4/71/4, coll. J. Paxton & P. Colman, 8 May 1971.

Taxonomy

Superfamily Majoidea Samouelle, 1819

Family Majidae Samouelle, 1819

Genus *Schizophroida* Sakai, 1933

Schizophroida colemani sp. nov.

Figs 1A–C, 2A,B, 3, 5A, 10A–C

Schizophrys hilensis.—Chilton, 1911: 546, 562–563.—Duffy & Ahyong, 2015: 83. [Not *Schizophrys hilensis* Rathbun, 1906].

Schizophroida hilensis.—Griffin & Tranter, 1986: 238–243, fig. 68c, c, pl. 19 [part, Australian and New Zealand specimens only].—Coleman, 2002: 56.—Poore, 2004: 380, fig. 114c.—Takeda & Webber, 2006: 196, 232, fig. 3A.—Williams *et al.*, 2008: 5.—Webber *et al.*, 2010: 227.—Ahyong & Wilkens, 2011: tab. 1.—Yaldwyn & Webber, 2011: 239.—Ahyong, 2015: 429. [Not *Schizophroida hilensis* (Rathbun, 1906)].

Holotype: AM P19606, male (cl 33.5 mm, pcl 27.9 mm, cw 20.2 mm), Ned's Beach, coll. I. Bennett, May 1964. **Paratypes**: AM P30966, 1 male (cl 18.4 mm, pcl 15.6 mm, cw 10.9 mm), 1 ovigerous female (cl 15.2 mm, pcl 13.5 mm, cw 9.2 mm), Deakon's Reef, 22 m, coll. N. Coleman, 30 November 1979; ZRC 2017.1280, 1 male (cl 18.0 mm, pcl 14.9 mm, cw 10.3 mm), Flat Rock, 25 m, AMPI Crust 866, coll. N. Coleman, 22 Feb 1979; AM P29818, 1 juvenile female (cl 9.9 mm, pcl 8.7 mm, cw 5.7 mm), Flat Rock, 25 m, coll. N. Coleman, 22 Feb 1979; AM P29819, 1 male (cl 19.4 mm, pcl 16.2 mm, cw 11.4 mm), Erscott's Hole, 3 m, AMPI Crust No. 860, coll. N. Coleman, 15 February 1979; AM P80451, 1 male (cl 18.5 mm, pcl 15.4 mm, cw 10.3 mm), Erscott's Hole, 4 m, AMPI Crust 954, coll. N. Coleman, 13 December 1979. All Lord Howe Island.

Other material examined. Australia.—New South Wales: AM P53496 1 ovigerous female (cl 26.8 mm, pcl 22.9 mm, cw 16.0 mm), between Jervis Bay and Gabo Island, NSW, 35°03'S 150°44'E, 30 m, coll. L. Vail & V. Harriott, March 1981.—Lord Howe Island, Tasman Sea: AM P29820, 1 juvenile female (cl 11.6 mm, pcl 9.8 mm, cw 6.8 mm), Ball's Pyramid, 10 m, AMPI Crust No. 875, coll. N. Coleman, 24 February 1979; AM P10301, 2 juvenile females (cl 16.1 mm, pcl 14.0 mm, cw 10.0 mm; cl 20.3 mm, pcl 17.2 mm, cw 12.0 mm), no specific locality; AM P46665, 1 juvenile female (cl 13.3 mm, pcl 11.2 mm, cw 7.5 mm), Malabar, 15 m, AMPI Crust No. 1007, coll. N. Coleman, 23 February 1980; AM P5288, 2 males (cl 9.0 mm, pcl 7.6 mm, cw 5.4 mm; cl 10.4 mm, pcl 8.8 mm, cw 6.3 mm), no specific locality; AM P29821, 1 male (cl 9.0, pcl 7.5 mm, cw 5.3 mm), 1 juvenile female (cl 24.7 mm, pcl 21.2 mm, cw 14.9 mm), no specific locality, coll. L. Clark, April 1932.—Tasman Sea: AM P39993, 1 male (cl 8.8 mm, pcl 6.9 mm, cw 4.7 mm), Elizabeth Reef, 29°57.8'S 159°04.7'E, outer slope, southern face, St. 36, coll. Australian Museum party, 11 December 1987; AM P40007, 1 juvenile female (cl 8.8 mm, pcl 7.3 mm, cw 5.1 mm), Elizabeth Reef, 29°57.7'S 159°02.8'E, SW outer slope, St. 34, coll. Australian Museum party, 11 December 1987.

New Zealand. Kermadec Islands: AM P88937, 1 male (cl 3.7 mm, pcl 3.1 mm, cw 2.1 mm), Stawell Shoal, N of Stella Passage, 30°31.778'S 178°33.570'W, 21–24 m, under encrusting coral on rock, K2011-92-8, coll. S. Keable & A. Reid, 25 May 2011; AM P88909, 3 males (cl 4.3, pcl 3.7 mm, cw 2.7 mm to cl 11.1 mm, pcl 8.9 mm, cw 6.4 mm), 4 females (cl 7.6 mm, pcl 6.0 mm, cw 4.6 mm to cl 14.2 mm, pcl 11.6 mm, cw 8.3 mm), W side l'Esperance Rock, 31°21.252'S 178°49.593'W, 12–20 m, rock walls, shelly sediment, sponges & coral scrapings, K2011-99-13, coll. S. Keable & A. Reid, 26 May 2011; AM P89040, 1 male (cl 6.0 mm, pcl 4.9 mm, cw 3.6 mm), Fishing Rock landing, Raoul Island, 29°14.552'S 177°54.215'W, 5 m, K2011-49-1, scrapings from rock wall, 17 May 2011; AM P89041, 1 juvenile male (cl 5.3 mm, pcl 4.3 mm, cw 3.1 mm), Dept of Conservation landing site, W side North Meyer Island, 29°14.674'S 177°52.688'W, 1 m, intertidal pools, K2011-5-6, coll. T. Trnski, 12 May 2011; AM P89274, 4 males (cl 4.6 mm, pcl 4.1 mm, cw 2.9 mm to cl 13.0 mm, pcl 10.7 mm, cw 7.8 mm), 4 females (cl 7.1 mm, pcl 5.9 mm, cw 4.3 mm to cl 9.4 mm, pcl 8.1 mm, cw 6.0 mm), Fishing Rock landing, Raoul Island, 29°14.552'S 177°54.215'W, 5 m, K2011-49-4, scrapings from rock wall, 17 May 2011.—Bay of Islands, North Island: NIWA (MITS) 21755, 1 ovigerous female (cl 27.1 mm, pcl 23.2 mm, cw 16.7 mm), from biofouling on floating wreck, BNZ1761CB2-CB, 10 March 2007.

Diagnosis. Rostral spines subparallel, margins straight, shorter than 0.25 pcl. Carapace protogastric region with transverse row of 4 distinct tubercles in adults; posterolateral margin with subdorsal tubercle between posteromedian spines and posterior branchial marginal spine; marginal branchial spines and posteromedian spines straight. Supraorbital eave moderately broad transversely, anterior width narrower than half basal width of rostral spine; intercalated spine prominent, separated from posterior spine of supraorbital eve by narrow U-shaped sinus. Basal antennal article with inner distal spine longer than outer. G1 with distal one-third distinctly curving laterally to about 50° to longitudinal axis.

Description. Carapace (Figs 1A–C, 2A, B) distinctly pyriform, longer than wide, regions weakly defined, surface densely covered with coarse straight and hooked setae. Rostral spines 0.13–0.22 pcl, margins straight, subparallel, occasionally slightly divergent in small juveniles. Supraorbital eave moderately broad transversely, anterior width narrower than half basal width of rostral spine; intercalated spine prominent, triangular, directed anterolaterally, separated from posterior spine of supraorbital eave by narrow U-shaped sinus. Carapace postfrontal region with longitudinal row of 2 tubercles behind each rostral spine; gastric region with 5 distinct tubercles: protogastric region with transverse row of 4 tubercles; mesogastric region with 1 tubercle; cardiac region with 2 low prominences; intestinal region with distinct median tubercle. Hepatic region inflated; prominent, conical, anterolaterally directed spine, larger than branchial spines; small subhepatic granules. Lateral branchial margin with 4 spines; posterior branchial margin with blunt subdorsal tubercle positioned midway between last branchial spine and paired posterior carapace spines. Posterior carapace spines straight, directed posteriorly, inclined slightly dorsad.

Epistome (Fig. 3A, B) with stout anteroventrally directed spine at base of each antennular sinus. Interantennular septum cristate; interantennular spine directed ventrally, not visible in dorsal view (Figs 2A, B). Basal antennal article distally bispinous, inner spine longer than outer spine.

Maxilliped 3 merus with rounded proximomesial lobe, margins usually with small denticles, distomesial margin with small spine; ischium distomesially auriculiform (Fig. 3C).

Cheliped 1.29–1.90 pcl (adult males), 1.02–1.21 pcl (adult females); articles subcylindrical to subovate in cross-section. Propodal palm smooth, fingers with gape in adult males, pollex occlusal margin with blunt tooth near midlength.

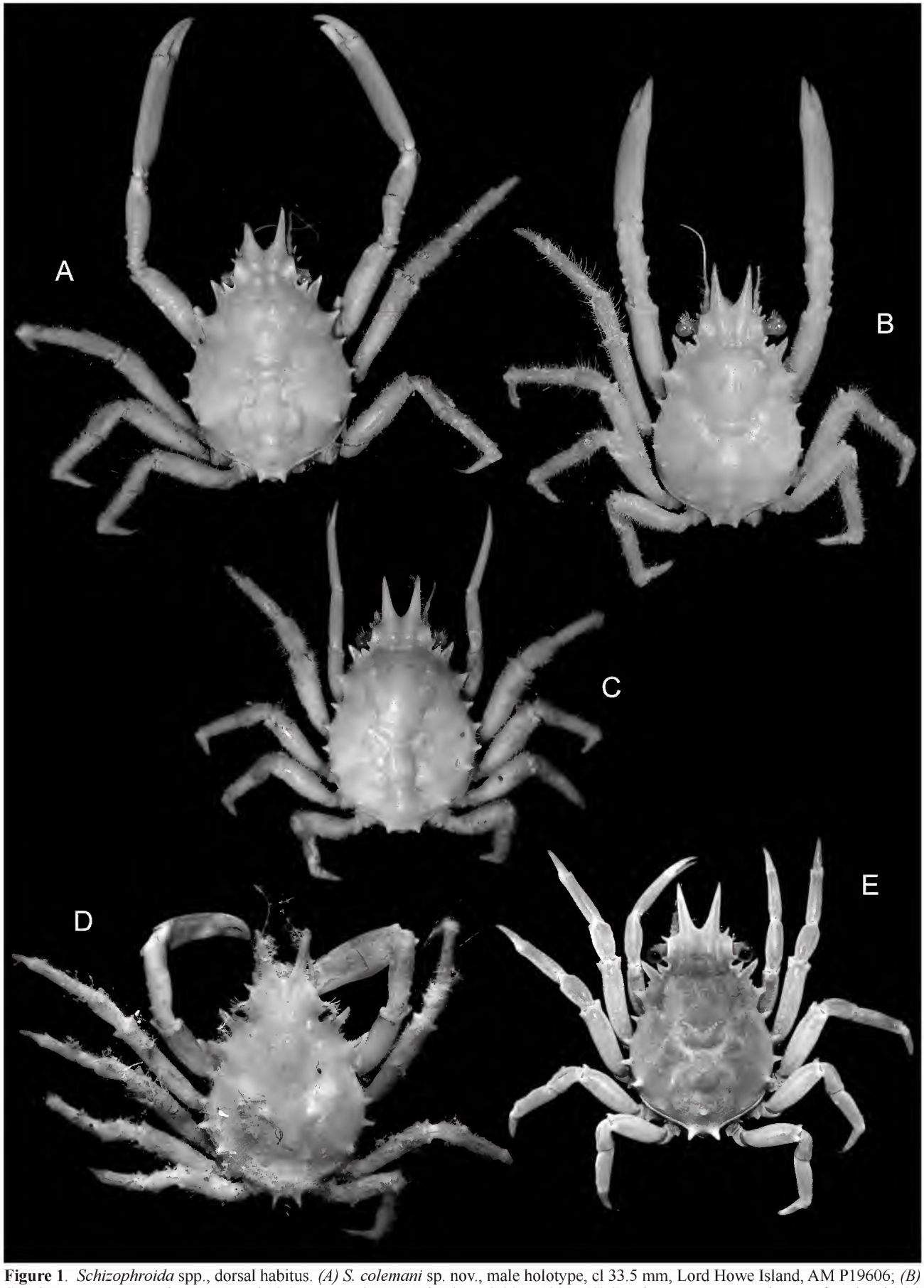

Figure 1. *Schizophroida* spp., dorsal habitus. *(A) S. colemani* sp. nov., male holotype, cl 33.5 mm, Lord Howe Island, AM P19606; *(B) S. colemani* sp. nov., male paratype, cl 18.0 mm, Lord Howe Island, ZRC 2017.1280; *(C) S. colemani* sp. nov., ovigerous female, cl 26.8 mm, between Jervis Bay and Gabo Island, NSW, AM P53496; *(D) S. hilensis* (Rathbun, 1906), male, cl 18.5 mm, Hawaii, ZRC 2000.417; *(E) S. hilensis* (Rathbun, 1906), male, cl 12.4 mm, Hawaii, ZRC 2000.459.

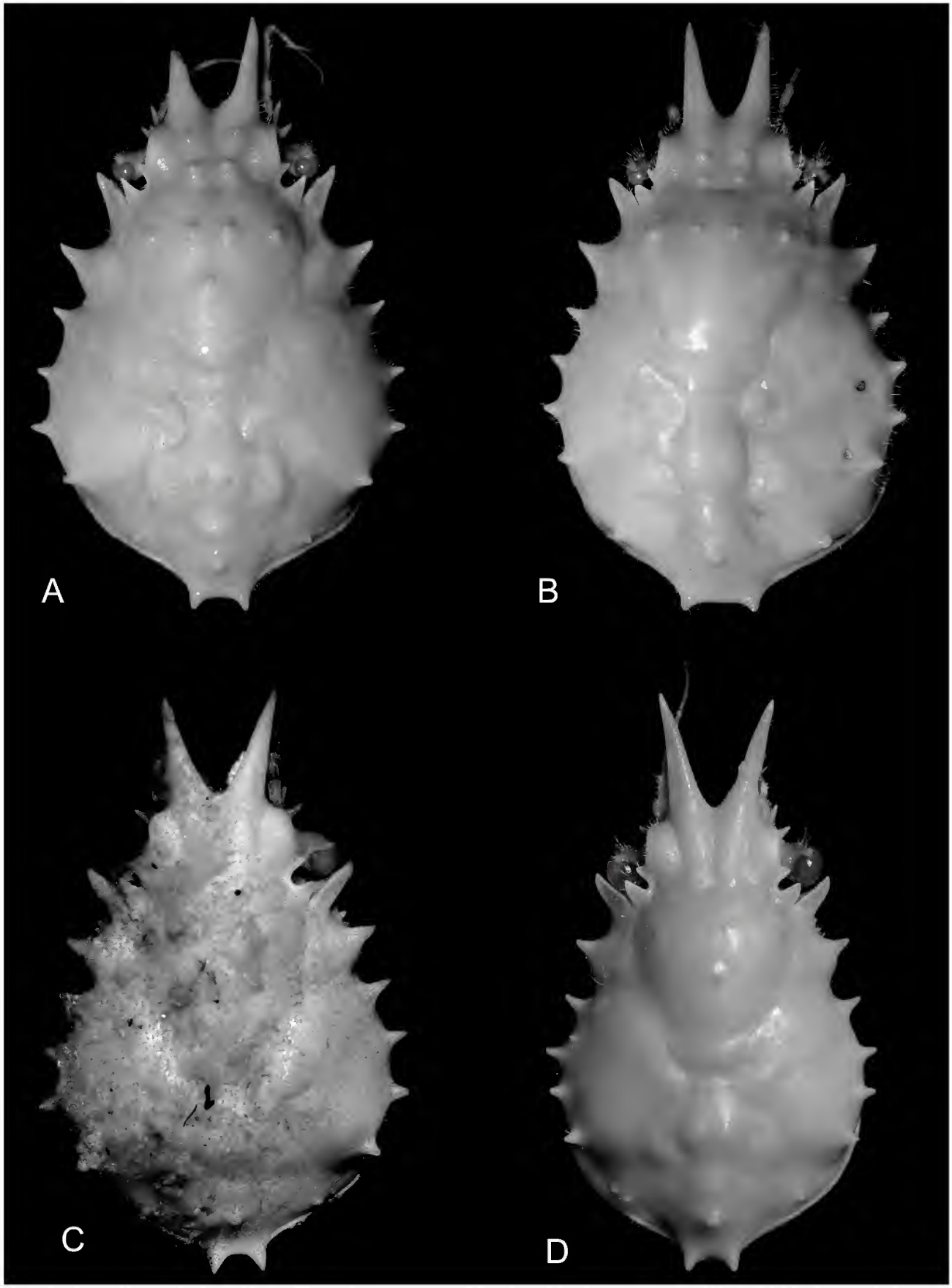

Figure 2. *Schizophroida* spp., carapace (all or most setae removed). *(A) S. colemani* sp. nov., male holotype, cl 33.5 mm, Lord Howe Island, AM P19606; *(B) S. colemani* sp. nov., ovigerous female, cl 26.8 mm, between Jervis Bay and Gabo Island, NSW, AM P53496; *(C) S. hilensis* (Rathbun, 1906), male lectotype, cl 16.1 mm, Hawaii, USNM 29794; *(D) Schizophroida* sp., juvenile female, cl 19.0 mm, New Caledonia, AM P29817.

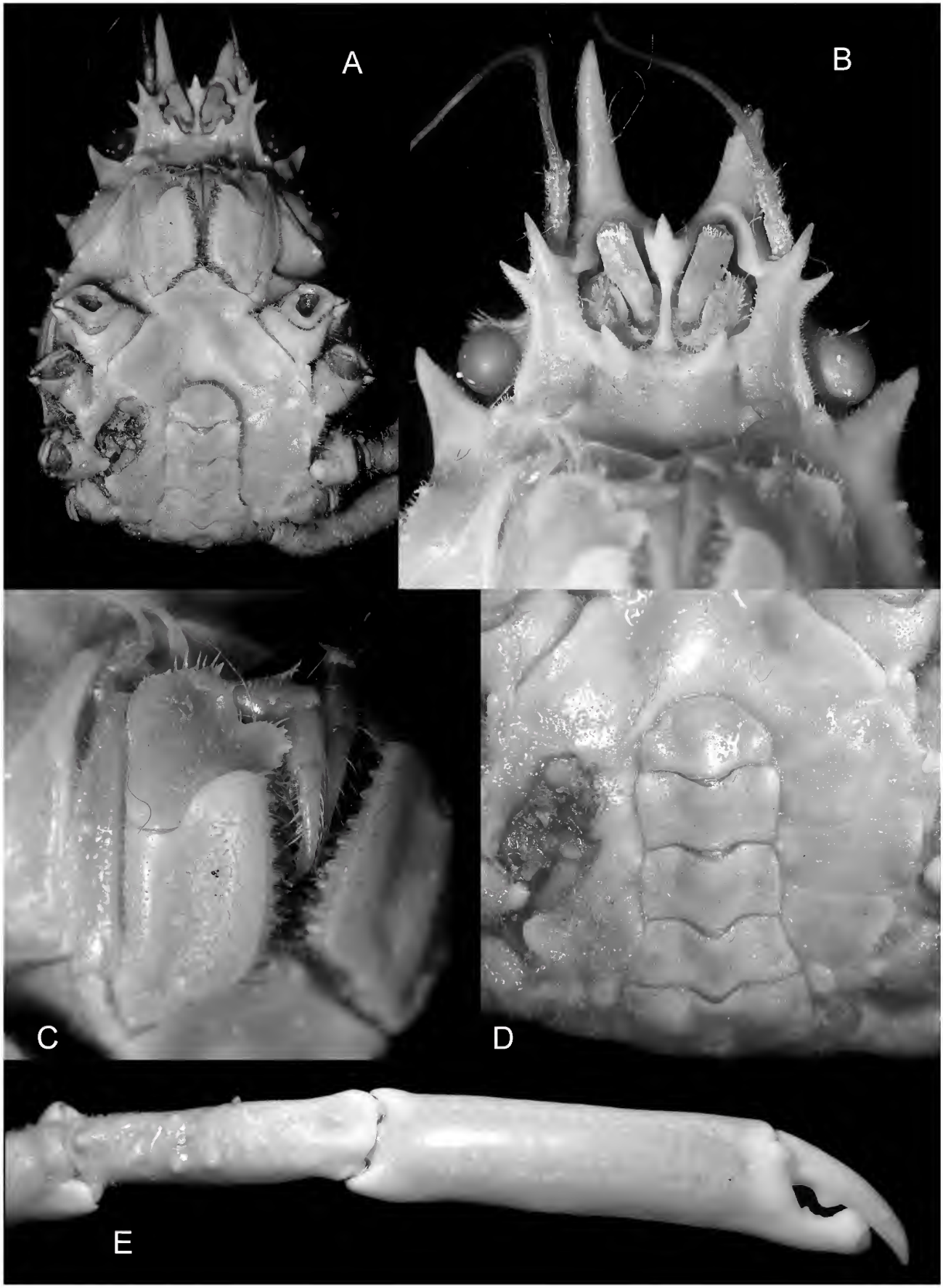

Figure 3. *Schizophroida colemani* sp. nov., male holotype, cl 33.5 mm, Lord Howe Island, AM P19606. *(A)* ventral surface; *(B)* anterior cephalothorax, ventral view; *(C)* right maxilliped 3; *(D)* pleon and sternum; *(E)* right cheliped.

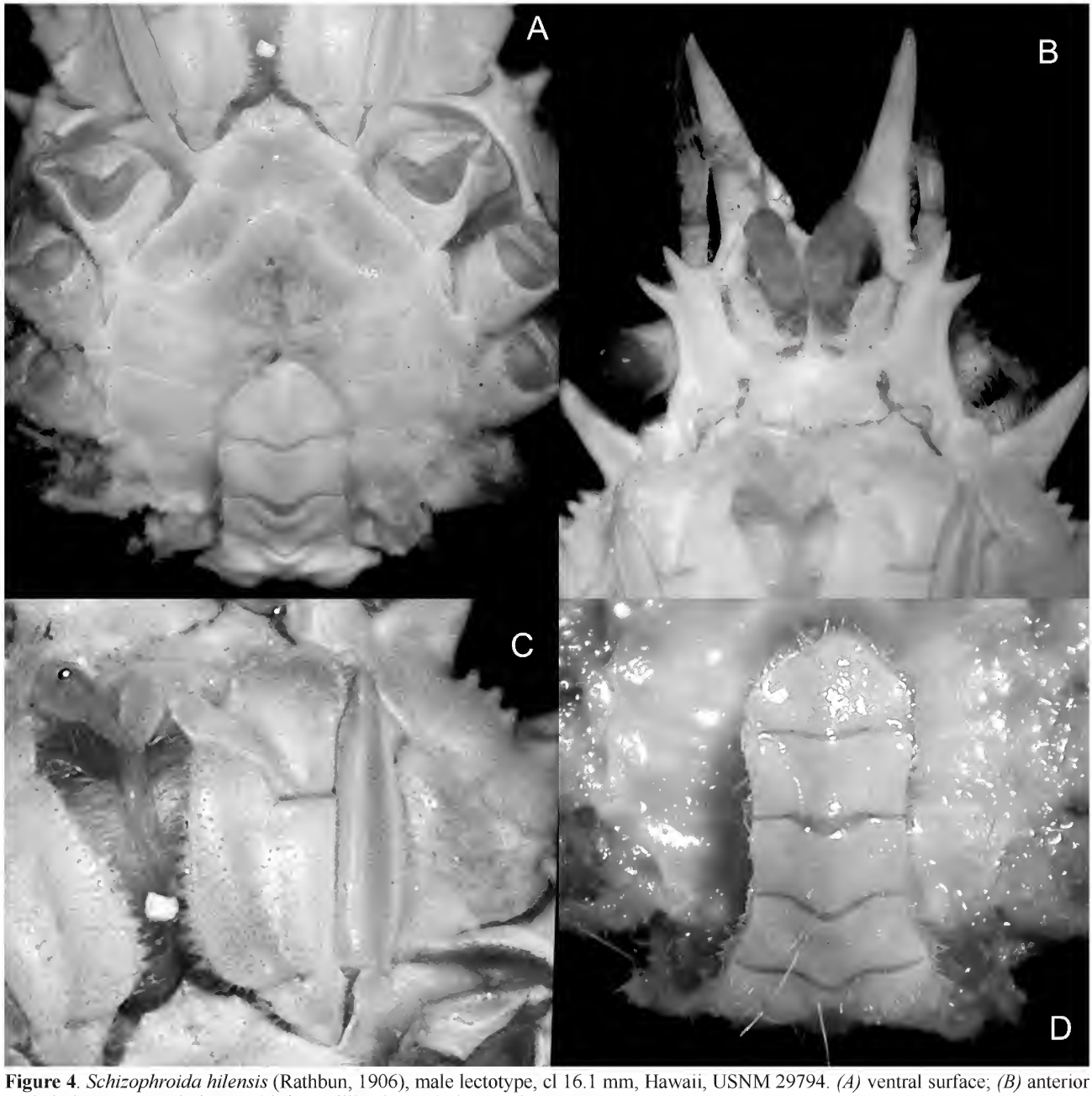

Figure 4. *Schizophroida hilensis* (Rathbun, 1906), male lectotype, cl 16.1 mm, Hawaii, USNM 29794. *(A)* ventral surface; *(B)* anterior cephalothorax, ventral view; *(C)* left maxilliped 3; *(D)* pleon and sternum.

Dactylus slightly shorter than half palm length, occlusal margin with blunt tooth proximally. Carpus 2/3 palm length in adult males, with 6–8 rounded granules (Figs 1A, B, 3E); in females, smooth, unarmed, as long as palm.

Pereopods 2–5 strongly setose, unarmed; dactylus simple, with curved, corneous tip. Pereopod 2 longest, merus 0.41–0.62 pcl (males), 0.42–0.46 pcl (females). Pereopod 5 merus 0.27–0.36 pcl (males), 0.28–0.32 pcl (females) (Fig. 5A).

Male pleon with somite 4 trapezoidal, lateral margins weakly concave, margins converging distally; somites 5 and 6 subrectangular, margins weakly convex, widest at midlength and distal end, respectively; telson wider than long, distal margin evenly rounded (Fig. 3D).

G1 long, slender, with distal one-third distinctly curving laterally to about 50° to longitudinal axis (Fig. 10A, B). G2 simple, distally bilobed, about one-fifth length of G2, exopod absent (Fig. 10C).

Etymology. The species is named after the late Neville Coleman, who collected most of the specimens of the type series.

Remarks. Griffin & Tranter (1986) noted that specimens of *Schizophroida* from Australia, New Zealand and New Caledonia differed from Hawaiian material in the degree of carapace tuberculation and the relative length of the basal antennal spines, although they considered them to be conspecific. The present results indicate that the Australian and New Zealand population should be referred to a new species, herein named *S. colemani* sp. nov. The New Caledonian specimen appears to represent a different species again, discussed further below. As such, *S. hilensis* (Figs 1D, E, 2C, 4, 5B, 10D–F) is presently known with certainty only from the Hawaiian Islands.

In having a subdorsal posterolateral branchial tubercle on

the carapace, *S. colemani* sp. nov. differs from *S. simodaensis* but resembles *S. hilensis*, *S. moai*, and *S. gracilis* sp. nov. Distinctions between *S. colemani* and *S. gracilis* are discussed under the account of the latter. *Schizophroida colemani* resembles *S. hilensis* in the strong curvature of the G1 (Fig. 10A, D), but differs in the position of the distomesial lobe on the G1 (closer to the tip in *S. colemani* as in *S. moai*), the lengths of the distal spines of the basal antennal segment (inner spine longer than outer in *S. colemani* versus equal in *S. hilensis*; Figs 3B, 4B), the narrower supraorbital eave (less than half basal rostral width versus exceeding half basal rostral width; Fig. 2A–C), in the presence of a transverse row of four prominent protogastic tubercles (at most two indistinct tubercles in *S. hilensis*; Fig. 2A–C), in subparallel versus divergent rostral spines (occasionally subparallel in *S. hilensis*; Figs 1, 2A–C), and a more evenly rounded male telson (Figs 3D, 4D). It should be noted that these differences are best observed in adults, in which the carapace tubercles and other structures are fully developed. *Schizophroida colemani* resembles *S. moai* in the distinctness of the carapace tubercles and the length of the basal antennal spines, but differs in having parallel instead of divergent rostral spines, less pronounced carapace spines in which the anterior branchial marginal spines are shorter, rather than subequal to hepatic spine, and the posterior spines are straight and slightly inclined dorsally, rather than upcurved. The male telson of *S. moai* is proportionally more elongate (Ng & Boyko, 2017: fig. 13B versus Fig. 3D) and the G1 is also less strongly curved laterally than in *S. colemani* (Ng & Boyko, 2017: fig. 17I, N versus Fig. 10A).

Schizophroida colemani matures between about 10 and 13.5 mm pcl, with sexual dimorphism in the more elongated, robust male chelipeds evident by about 15 mm pcl (Fig. 1A–C). The smallest ovigerous female examined here measured 13.5 mm pcl, though Takeda & Webber (2006) reported ovigerous specimens as small as 10.8 mm. Slight dimorphism is also evident in the length of the ambulatory legs as indicated by the proportionally longer pereopod 5 merus in adult males (0.33–0.36 pcl in males; 0.29–0.31 pcl females) (Fig. 1A–C). Juvenile males, however, have pereopod proportions similar to those of females.

Allometric variation in *S. colemani* is evident chiefly in the distinctness of the carapace tubercles, being most distinct in the largest specimens. The protogastric tubercles are usually absent in juveniles to about 10 mm pcl, and clearly evident by about 15 mm pcl. The protogastric tubercles can be indistinct in small specimens and are best observed by temporarily drying the surface of the gastric region. Similarly, the distinctness of the basal rostral tubercles is most pronounced in large specimens. The rostral spines are subparallel in all specimens except a few juveniles smaller than 10 mm pcl. In adult *S. colemani*, the outer basal antennal spine is shorter than the inner spine; however, the inner spine is initially the shorter in the smallest specimens (pcl 3.1–4.3 mm; apparently first and second crab stage) becoming longer with increasing body size such that the spines are subequal by about 7 mm pcl and by about 9 mm pcl, the inner spine is longer than the outer spine.

As with many majoids, *Schizophroida* carries algal and other biofouling as camouflage. An ovigerous female of *S. colemani* (AM P53496) from off southern New South Wales was found with three janiroidean isopods and one specimen of the amphipod *Dulichiella* cf. *australis* (Haswell, 1879) (AM P53496) amongst the algal fouling on the carapace.

The northernmost records of *S. colemani* are from Lord Howe Island and the Kermadec Islands (~30–31°S) and southernmost records from Australia are off southern New South Wales (35°S). In New Zealand, an ovigerous female was collected well south of its known natural range (Kermadecs) amongst biofouling on the floating wreck of a Taiwanese fishing vessel intercepted in 2007 in the Bay of Islands, northeastern New Zealand (Williams et al., 2008; as *S. hilensis*, NIWA (MITS) 21755). *Schizophroida colemani* is not known from mainland New Zealand; recruitment to the wreck probably occurred in the northern Tasman Sea in the vicinity of Lord Howe Island or the Kermadecs.

The specimen from New Caledonia reported by Griffin & Tranter (1986) (juvenile female pcl 15.2 mm, incomplete, lacking most pereopods, AM P29817; Fig. 3D) agrees with *S. colemani* in most respects but differs by its distinctly divergent and more elongate rostral spines (0.25 versus 0.13–0.22 pcl) and evidently matures at a larger size (*S. colemani* matures between 10.8 and 13.5 mm pcl). The protogastric tubercles are small and best observed when the carapace surface is dried. Additionally, the New Caledonian specimen was collected much further north than the northernmost *S. colemani* (Kermadec Islands) and from 85–100 m depth, considerably deeper than other species of the genus (intertidal to shallow sublittoral depths not exceeding 30 m). These bathymetric differences may be of significance; despite intensive sampling, *Schizophroida* has not been recorded from deeper waters around northern New Zealand including the Kermadec Ridge (Ahyong, 2008; Yaldwyn & Webber, 2011). The New Caledonian specimen probably represents an undescribed species, but is retained here as *Schizophroida* sp. pending collection of mature and more complete specimens.

Distribution. Coastal southeastern Australia, the Tasman Sea (Lord Howe Island, Elizabeth Reef) and the Kermadec Islands, New Zealand; intertidal rocky and coral reefs to 30 m.

Schizophroida gracilis sp. nov.

Figs 5C, D, 6–9, 10G–L

Schizophroida hilensis.—Paulay et al., 2003: 496 [Guam].—Yang et al., 2008: 780 [Taiwan]. [Not *Schizophroida hilensis* (Rathbun, 1906)].

Holotype: NTOU, male (cl 20.6 mm, pcl 11.5 mm, cw 10.5 mm), Lanyu Island, Taitung County, 22°N 121°W, coll. S.-H. Wu, August 2000. **Paratypes**: ZRC 2017.1026, 1 male (cl 21.3 mm, pcl 15.5 mm, cw 10.8 mm), 2 females (cl 20. 5 mm, pcl 15.8 mm, cw 11.0 mm; cl 22.8 mm, pcl 17.6 mm, cw 12.0 mm), Lanyu Island, 4–5 m, reefs, coll. S.-H. Wu, 7 October 1997–August 2000; AM P101292, 1 female (cl 22.7 mm, pcl 17.1 mm, cw 12.0 mm), same. All Taiwan.

Other material examined. Guam: ZRC 2000.625, 1 male (cl 15.1 mm, pcl 11.8 mm, cw 7.8 mm mm), Pago Bay, reef front, under overhang, 5 m, coll. G. Paulay, 2 December 1995; ZRC 2000.626, 1 male (cl 21.1 mm, pcl 15.7 mm, cw 10.8 mm), 1 spent female (cl 19.5 mm, pcl 15.4 mm, cw 10.5 mm), 1 ovigerous female (cl 17.7 mm, pcl 13.6 mm, cw 9.4 mm), beach, in channels, on walls, night dive, ca. 3 m, coll. L. Kirkendale, 5 December 1998.

Diagnosis. Rostral spines subparallel, margins slightly sinuous, longer than 0.25 pcl. Carapace protogastric region with transverse row of no more than 2 low tubercles in adults; posterolateral margin with subdorsal tubercle between posteromedian spines and posterior branchial marginal spine;

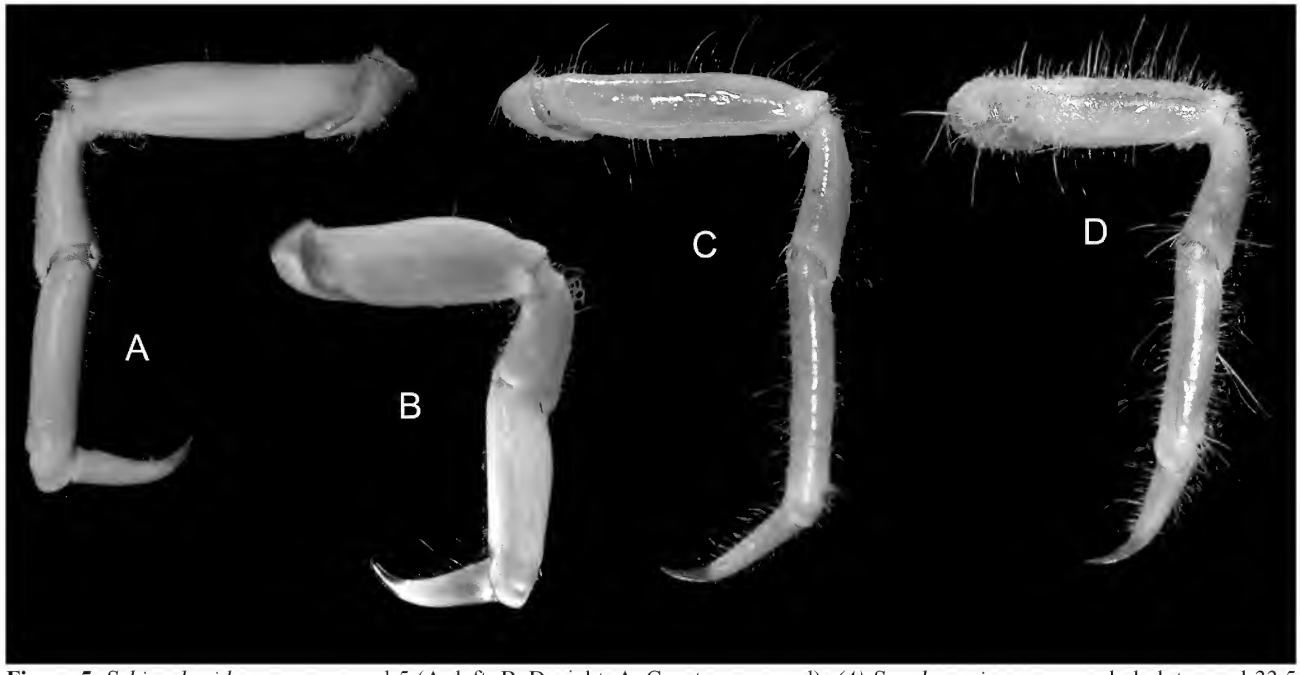

Figure 5. *Schizophroida* spp., pereopod 5 (A, left; B–D, right; A–C, setae removed). *(A) S. colemani* sp. nov., male holotype, cl 33.5 mm, Lord Howe Island, AM P19606; *(B) S. hilensis* (Rathbun, 1906), male, cl 12.4 mm, Hawaii, ZRC 2000.459; *(C) S. gracilis* sp. nov., holotype male, cl 20.6 mm, Taiwan, NTOU; *(D) S. gracilis* sp. nov., male, cl 21.1 mm, Guam, ZRC 2000.626.

marginal branchial spines and posteromedian spines straight. Basal antennal article with inner distal spine longer than outer. Supraorbital eave transversely narrow, anterior width distinctly narrower than half basal width of rostral spine; intercalated spine small, triangular, directed almost laterally, separated from posterior spine of supraorbital eave by wide sinus with divergent margins. G1 with distal half distinctly curving laterally about 80° to longitudinal axis.

Description. Carapace (Figs 6, 7) distinctly pyriform, longer than wide, regions weakly defined, surface densely covered with coarse straight and hooked setae. Rostral spines 0.27–0.38 pcl, margins slightly sinuous, subparallel. Supraorbital eave transversely narrow, anterior width distinctly narrower than half basal width of rostral spine; intercalated spine small, triangular, directed almost laterally, separated from posterior spine of supraorbital eave by wide sinus with divergent margins. Carapace postfrontal region with longitudinal row of 2 tubercles behind each rostral spine; gastric region with low tubercles: protogastric with low to prominent granule on each side; mesogastric with 1 very low, indistinct tubercle; cardiac region with very low, indistinct granule; intestinal region with low tubercle. Hepatic region inflated; prominent, broad, conical, laterally directed spine, larger than branchial spines; small subhepatic granules. Lateral branchial margin with 4 spines; posterior branchial margin with blunt subdorsal tubercle positioned midway between last branchial spine and paired posterior carapace spines (subdorsal tubercle indistinct in 17.1 mm pcl female; AM P101292). Posterior carapace spines straight, directed posteriorly, inclined slightly dorsad.

Epistome (Figs 8B, 9B) with stout anteroventrally directed spine at base of each antennular sinus. Interantennular septum cristate; interantennular spine recurved anteriorly, clearly visible in dorsal view (Fig. 7). Basal antennal article distally bispinous, inner spine longer than outer spine (Fig. 8B).

Maxilliped 3 merus with rounded proximomesial lobe, margins usually with small denticles, distomesial margin with small spine; ischium distomesially auriculiform (Figs 8C, 9C).

Cheliped 1.19–1.64 pcl (male), 1.10–1.26 pcl (female); articles subcylindrical to subovate in cross-section. Propodal palm smooth, fingers with gape in adult males, pollex occlusal margin with blunt tooth near midlength. Dactylus slightly shorter than half palm length, occlusal margin with blunt tooth proximally. Carpus two-thirds to three-fourths palm length in adult males, with 8–11 rounded granules (Fig. 6A, C); in females, smooth, unarmed, as long as palm.

Pereopods 2–5 strongly setose, unarmed; dactylus simple, with curved, corneous tip. Pereopod 2 longest, merus 0.54–0.61 pcl (males), 0.50–0.53 pcl (females). Pereopod 5 merus 0.36–0.41 pcl (males), 0.31–0.36 pcl (females) (Figs 5C, D, 6).

Male pleon with somite 4 trapezoidal, lateral margins weakly concave, margins converging distally; somites 5 and 6 subrectangular, margins weakly convex, widest at midlength and distal end, respectively; telson wider than long, distal margin evenly rounded (Figs 8D, 9D).

G1 long, slender, with distal half distinctly curving laterally about 80° to longitudinal axis, becoming almost perpendicular (Fig. 10G, J). G2 simple, distally bilobed, about one-fifth length of G1, exopod absent (Fig. 10I, L).

Etymology. The species is named after its relatively long and slender pseudorostral spines and ambulatory legs.

Remarks. *Schizophroida gracilis* sp. nov. is distinctive in the genus in the possession of long, slightly sinuous, subparallel rostral spines (0.27–0.38 pcl), a narrow supraorbital eave (anterior width distinctly narrower than half rostral spine width), a wide V-shaped rather than narrrow U-shaped sinus between the intercalated spine and the posterior spine of the supraorbital eave and a much more strongly bent G1 in which the distal portion becomes almost perpendicular to the proximal portion. Although most other species of

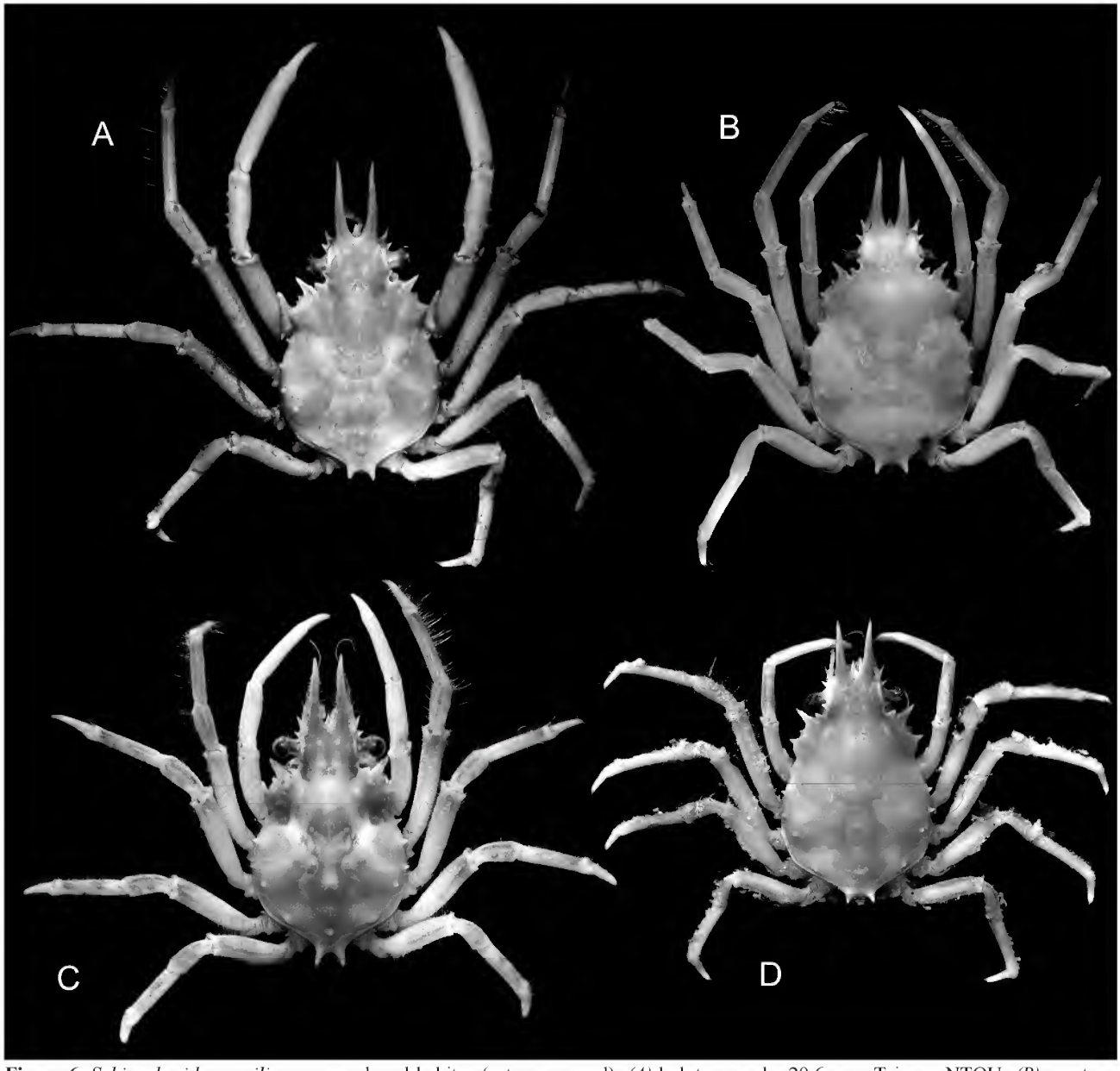

Figure 6. *Schizophroida gracilis* sp. nov., dorsal habitus (setae removed). *(A)* holotype male, 20.6 mm, Taiwan, NTOU; *(B)* paratype female, cl 22.8 mm, Taiwan, ZRC 2017.1026; *(C)* male, cl 21.1 mm, Guam, ZRC 2000.626; *(D)* female, cl 19.5 mm, Guam, ZRC 2000.626.

Schizophroida have distinctly divergent rostral spines and a comparatively wide supraorbital eave, *S. colemani* also has subparallel rostral spines and a relatively narrow supraorbital eave. The rostral spines of *S. colemani*, however, are proportionately shorter than those of *S. gracilis* (0.13–0.22 versus 0.27–0.38 pcl in adults), and the supraorbital eave is comparatively wider, but still narrower than half rostral spine width (Figs 3A, B, 4).

All examined specimens appear to be mature, with males having slightly more elongated walking legs and distinctly more robust chelipeds than females. Specimens from Taiwan and Guam are almost indistinguishable, but differ slightly in pereopod length as measured by the pereopod 5 merus. Taiwanese males have a proportionally longer pereopod 5 merus than those from Guam (0.38–0.41 pcl versus 0.36 pcl), although corresponding measurements in females overlap (0.31–0.37 pcl versus 0.34 pcl) (Figs 5C, D, 6). Additionally, the cheliped of the largest male from Taiwan is more elongated (1.64 pcl versus 1.19 pcl) and more robust than a size-matched male from Guam (Fig. 2), suggesting that size at maturity might differ between the two populations. In the Taiwanese specimens, the lateral margins of male pleonites 4–6 are distincly more sinuous, with somite 4 more trapezoidal in shape compared to those from Guam (Figs 8D, 9D). The differences, however, are not substantial, and, like the length of the chelipeds, may be associated with maturity. It is possible that these differences indicate that the Taiwan and Guam populations belong to different species, but the available material does not provide sufficient evidence for this. The marked similarities in the structures of their carapaces, rostrums, and notably the G1s, suggest that it is best to treat the Taiwanese and Guam material as conspecific for the time being.

Distribution. Presently known only from Taiwan and Guam; rocky and coral reefs, 3–5 m.

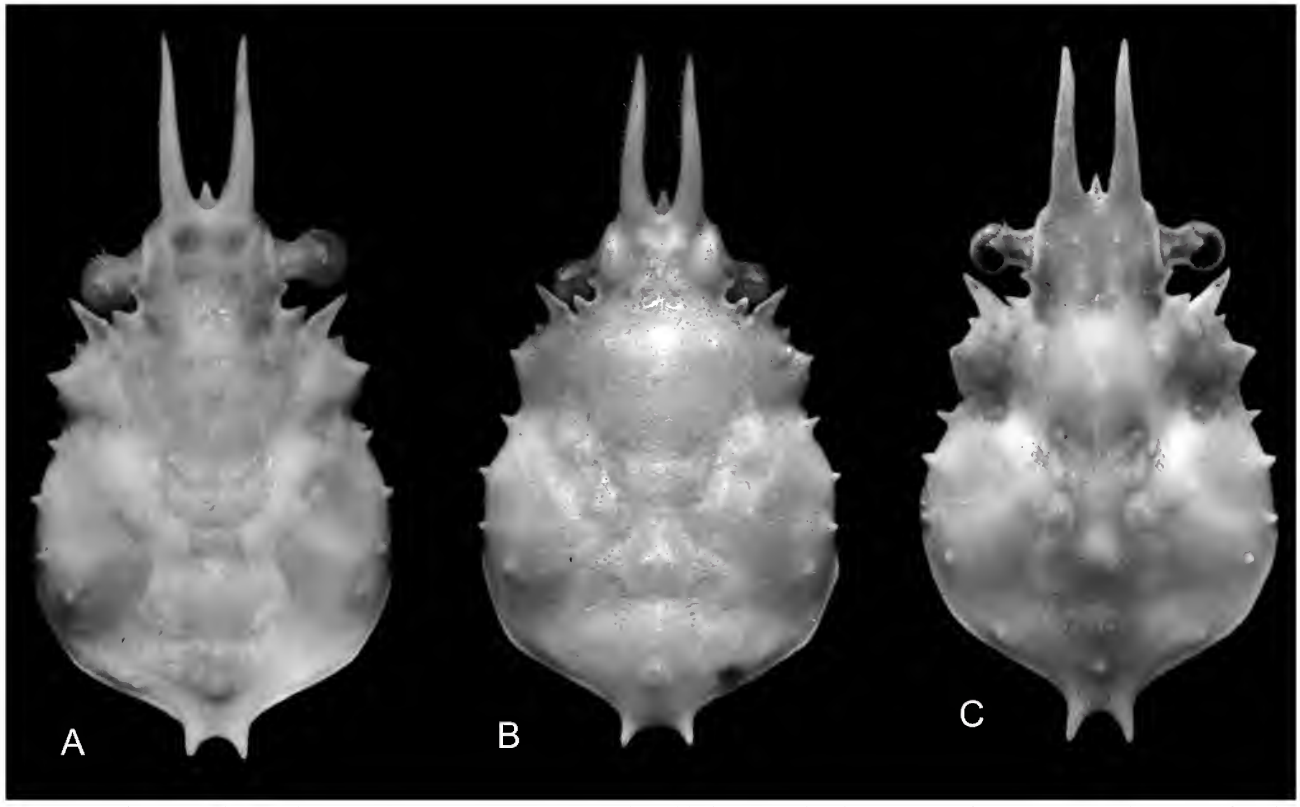

Figure 7. *Schizophroida gracilis* sp. nov., carapace (setae removed). *(A)* holotype male, cl 20.6 mm, Taiwan, NTOU; *(B)* paratype female, cl 22.8 mm, Taiwan, ZRC 2017.1026; *(C)* male, cl 21.1 mm, Guam, ZRC 2000.626.

Key to species of *Schizophroida*

1 Carapace posterolateral margin without subdorsal tubercle between posteromedian spines and posterior branchial marginal spine ..... [Japan] *S. simodaensis* Sakai, 1933

—— Carapace with posterolateral margin with subdorsal tubercle between posteromedian spines and posterior branchial marginal spine 2

2 Basal antennal article with inner distal spine as long as outer spine. Supraorbital eave anteriorly wider than half basal width of rostral spines ..... [Hawaii] *S. hilensis* (Rathbun, 1906)

—— Basal antennal article with inner distal spine longer than outer spine. Supraorbital eave anteriorly narrower than half basal width of rostral spines 3

3 Sinus between intercalated spine and posterior spine of supra-orbital eave wide, internal margins divergent ..... [Taiwan, Guam] *S. gracilis* sp. nov.

—— Sinus between intercalated spine and posterior spine of supra-orbital eave narrow, internal margins subparallel, U-shaped 4

4 Rostral spines divergent. Carapace marginal branchial spines and posteromedian spines curving upwards ..... [Easter Island] *S. moai* Ng & Boyko, 2017

—— Rostral spines subparallel. Carapace marginal branchial spines and posteromedian spines straight, although inclined upwards ..... [Australia, New Zealand] *S. colemani* sp. nov.

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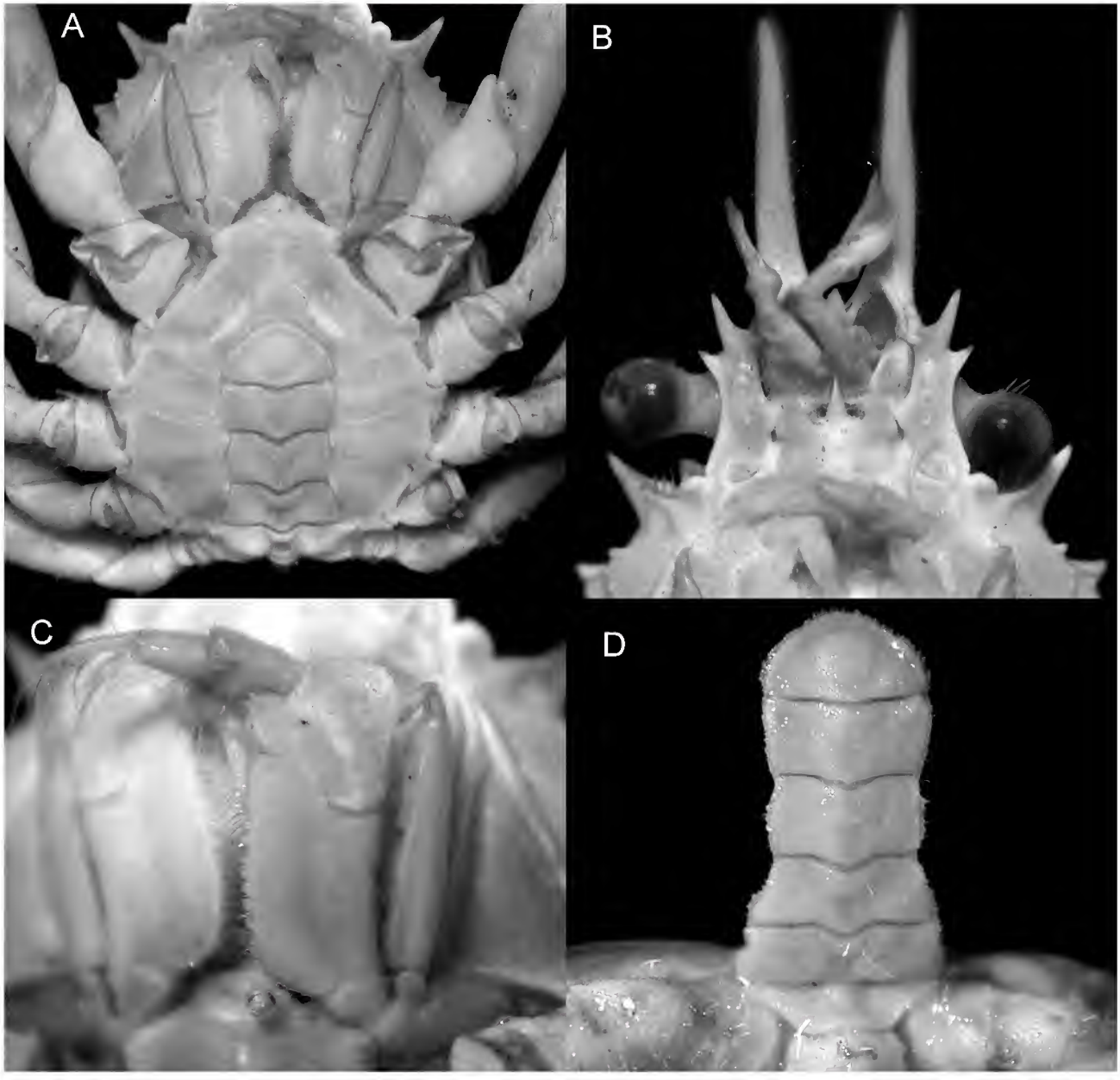

Figure 8. *Schizophroida gracilis* sp. nov., holotype male, cl 20.6 mm, Taiwan, NTOU. *(A)* ventral surface; *(B)* anterior cephalothorax, ventral view; *(C)* right and left maxilliped 3; *(D)* pleon.

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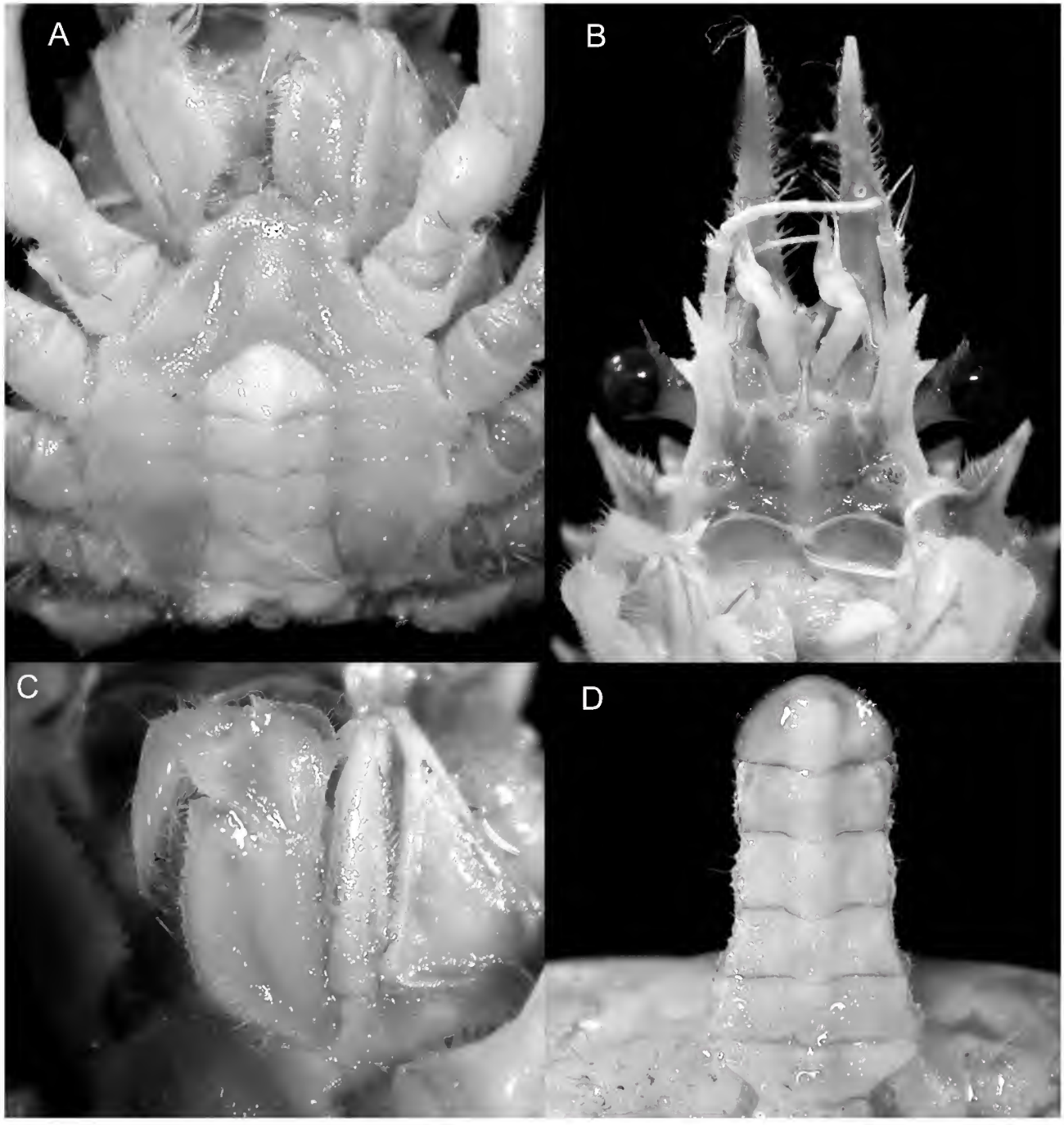

Figure 9. *Schizophroida gracilis* sp. nov., male, cl 21.1 mm, Guam, ZRC 2000.626. *(A)* ventral surface; *(B)* anterior cephalothorax, ventral view; *(C)* left maxilliped 3; *(D)* pleon.

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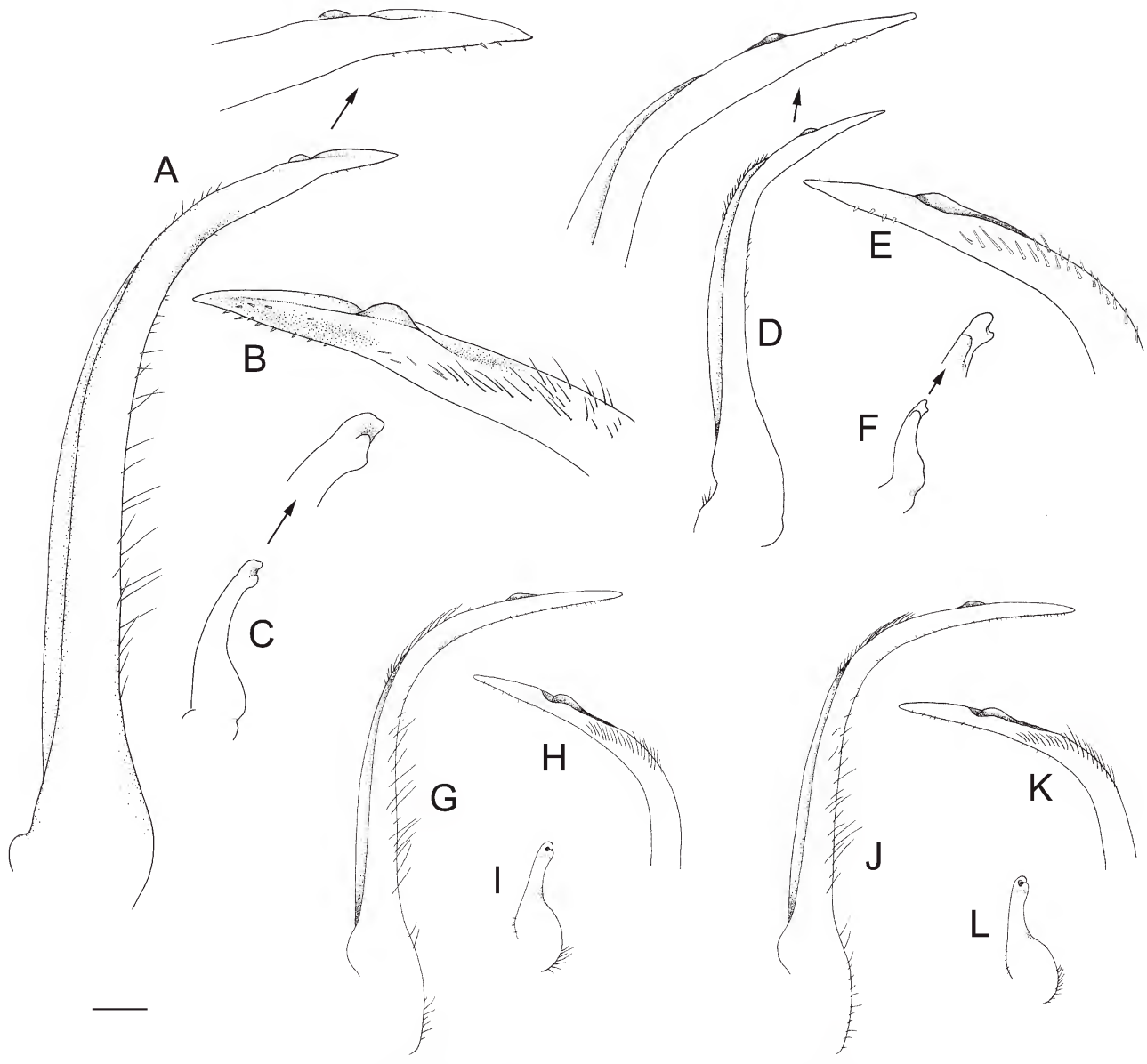

Figure 10. *Schizophroida* spp., G1 and G2. *(A–C) S. colemani* sp. nov., male holotype, cl 33.5 mm, Lord Howe Island, AM P19606; *(D–F) S. hilensis* (Rathbun, 1906), male lectotype, cl 16.1 mm, Hawaii, USNM 29794; *(G–I) S. gracilis* sp. nov., holotype male, cl 20.6 mm, Taiwan, NTOU; *(J–L) S. gracilis* sp. nov., male, cl 21.1 mm, Guam, ZRC 2000.626. A, D, G, J: left G1, abdominal view. B, E, H, K: left G1 distal end, sternal view. C, F, I, L: left G2, abdominal view. Scale: A, C, D, F, G–L = 0.5 mm, B, E = 0.25 mm.

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Penelope B. Berents orcid.org/0000-0002-1560-3141
J. K. Lowry orcid.org/0000-0003-0437-6753

The New Crustacean Amphipod Genus *Kapalana* from Australian Waters (Senticaudata, Ischyroceridae, Ischyrocerinae, Cerapodini)

Penelope B. Berents* and J. K. Lowry

Australian Museum Research Institute,
Australian Museum, 1 William Street, Sydney NSW 2010, Australia
penny.berents@austmus.gov.au

Abstract. *Kapalana* g. nov. is proposed and described for seven new species of Australian cerapodin amphipods: *K. amelga* sp. nov.; *K. durraween* sp. nov.; *K. kimbla* sp. nov.; *K. maia* sp. nov.; *K. michaelmas* sp. nov.; *K. stebbingi* sp. nov. and *K. wadei* sp. nov. In all of these species the females show a form of parental care in that the juveniles build their initial tubes in a ring around the tube of the adult female. *Cerapus flindersi* Stebbing, 1888 is tentatively assigned to the new genus *Kapalana*.

Keywords. Crustacea; Amphipoda; Ischyroceridae; Cerapodini; *Kapalana*; Australia; new genus; new species; taxonomy; parental care.

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Just (2017) established the tribe Cerapodini Smith, 1880 within the ischyrocerine subfamily based on clades described by Lowry & Berents (1996). The tribe comprised five genera (*Bathypoma* Lowry & Berents, 1996; *Cerapus* Say, 1817; *Notopoma* Lowry & Berents, 1996; *Paracerapus* Budnikova, 1989; *Runanga* J. L. Barnard, 1961) and was confirmed by Souza-Filho & Serejo (2014).

The Cerapodoni is currently represented in Australian waters by five species of *Cerapus*, the deep water species *Bathypoma enigma* Lowry & Berents, 1995 from off the Tasmanian coast, *Notopoma stoddartae* Lowry & Berents, 1996 from Elizabeth and Middleton Reefs and *Runanga coxalis* J. L. Barnard, 1961 in the Tasman Sea.

A group of eight species in the Cerapodini, also found in Australian waters, is described here in the new genus *Kapalana* defined by: *(a)* the posterior margin of peduncular article 1 modified into a strong projection; *(b)* the peduncles of antennae 1 and 2 covered in scales; and *(c)* juveniles attach their initial tubes to tubes of the female parent (Figs 4, 12) forming a ring which encircles the tube. There may be at least two generations attached to a female parent tube at any one time.

Apomorphic character states, common in some genera, such as the tiny scales on the peduncles of the antennae in the apparently endemic Australian genus *Kapalana,* are reported in one species of *Notopoma (N. argentina)* living in southern South America, and the presence of a holdfast on the tube in one species of *Kapalana (K. michaelmas)* is also known in the South African species *Notopoma africana*, indicating the possibility of a common ancestor for *Kapalana* and *Notopoma*. Therefore, there appears to be an ancient connection between *Kapalana* and *Notopoma*. *Notopoma* is a diverse, widespread genus mainly defined by the peduncle of antenna 1 which folds into a neat operculum. The genus

* author for correspondence

does not occur on the Australian plate, if the hidden continent Zelandia is accepted (Mortimer *et al*., 2017). The rather unspecialized genus *Bathypoma,* however, which occurs off the coast of Tasmania, shares the operculum (see Lowry & Berents, 1996: 77) with *Notopoma*, a further example of shared apomorphic character states among taxa in the Cerapodini *Cerapus* clade.

Material and methods

The generic diagnostic description and the species descriptions were generated from a DELTA database (Dallwitz, 2010) to the *Cerapus* group species of the world. The **bolded** text distinguishes the genus in at least two characteristics from every other cerapodin taxon. Material is lodged in the Australian Museum, Sydney (AM), Museum Victoria (MV) and the South Australian Museum (SAM). The following abbreviations are used on the plates: **A**, antenna; **EP**, epimeron; **G**, gnathopod; **H**, head; **IP**, inner plate of maxilliped; **LL,** lower lip; **MD**, mandible; **MP**, maxilliped; **MX**, maxilla; **OP**, outer plate of maxilliped; **p**, palp; **P**, pereopod; **PL**, pleopod; **U**, uropod; **UR**, urosome; **l**, left; **r**, right. The terminology for cuticular structures follows Watling (1989).

Mouthparts do not provide useful diagnostic characters for species in the genus *Kapalana* and are therefore illustrated for *K. wadei* only. Locality data presented in *Material examined* includes museum station data codes (e.g. NSW 2034, MI NSW 3369, BSS 112, WPNPA).

Checklist and distribution of the Cerapodini Smith, 1880; 6 genera, 48 species.

taxon	general distribution
Bathypoma enigma Lowry & Berents, 1996	Australia: Tasmania
Cerapus alquirta (Barnard & Drummond, 1981)	Australia: Victoria
Cerapus benthophilus Thomas & Heard, 1979	Gulf of Mexico
Cerapus bundegi Lowry & Berents, 2005	Australia: Western Australia
Cerapus calamicola (Giles, 1885)	India: Gulf of Mannar
Cerapus chaomai Lowry & Berents, 2002	Thailand: Trang
Cerapus cudjoe Lowry & Thomas, 1991	USA: Florida
Cerapus erae Bulycheva, 1952	Japan: Russia
Cerapus jonsoni Valério-Berardo, Souza & Rodrigues, 2008	Brazil: Santos Continental Shelf
Cerapus longirostris Shen, 1936	China: Shantung Peninsula; Japan: Uematsu
Cerapus maculanigra Zeina & Asakura, 2017	Red Sea
Cerapus micronesicus Myers, 1995	Micronesia: Kosrae
Cerapus murrayae Lowry & Berents, 2005	Australia: New South Wales
Cerapus nudus Just, 2009	Australia: Queensland
Cerapus oceanicus Lowry, 1985	Western Samoa: Upolu
Cerapus orteai Ortiz & Thomas, 2007	Costa Rica
Cerapus pacificus Lowry, 1985	Fiji: Viti Levu
Cerapus thomasi Ortiz & Lemaitre, 1997	Colombia: Gulf of Morrosquillo
Cerapus tubularis Say, 1817	USA: north-east coast
Cerapus volucola Lowry & Berents, 2005	Australia: Queensland; Papua New Guinea, Madang Lagoon
Cerapus yuyatalay Lowry & Berents, 2002	Thailand, Sikao district
Kapalana amelga sp. nov.	Australia: New South Wales
Kapalana durraween sp. nov.	Australia: New South Wales
Kapalana flindersi (Stebbing, 1888)	Australia: Queensland
Kapalana kimbla sp. nov.	Australia: Victoria; South Australia
Kapalana maia sp. nov.	Australia: Victoria; Tasmania
Kapalana michaelmas sp. nov.	Australia: South Australia; Western Australia
Kapalana stebbingi sp. nov.	Australia: New South Wales; Victoria
Kapalana wadei sp. nov.	Australia: New South Wales
Notopoma africana Lowry & Berents, 1996	South Africa: south-east of St Lucia
Notopoma argentina Alonso de Pina, 2005	Argentina
Notopoma cidaridis Berge, Vader & Lockhart, 2004	Antarctica: north of Elephant Island
Notopoma crassicornis (Spence Bate, 1855)	United Kingdom: England; Northumberland
Notopoma fallohidea (Lowry, 1981)	New Zealand: Kaikoura
Notopoma fluminense Valério-Berardo, *et al*., 2008	Brazil: Campos Basin
Notopoma harfoota (Lowry, 1981)	New Zealand: Kaikoura; Wellington
Notopoma lowryi Souza-Filho & Serejo, 2014	Brazil
Notopoma lukini (Tzvetkova, 1992)	Russia: Kurile Islands
Notopoma moorea Lowry & Berents, 1996	Society Islands: Moorea
Notopoma opposita (K. H. Barnard, 1932)	Antarctica: South Georgia; Palmer Archipelago
Notopoma sismithi (Stebbing, 1888)	Subantarctic: Kerguelen Islands; Macquarie Island
Notopoma stoddartae Lowry & Berents, 1996	Australia: Elizabeth and Middleton Reefs, Tasman Sea
Notopoma stoora (Lowry, 1981)	New Zealand: Kaikoura
Notopoma teresae Souza-Filho & Serejo, 2014	Brazil
Paracerapus comparativus (Kudrjaschov, 1975)	Russia: Kurile Islands
Paracerapus polutovi (Gurjanova, 1951)	Russia: East Kamchatka, Bering Sea
Runanga coxalis J. L. Barnard, 1961	Tasman Sea
Runanga wairoa McCain, 1969	New Zealand: East of Dunedin

Key to genera of Cerapodini

1	Antenna 1 peduncular article 3 forming an opercular cap	2
——	Antenna 1 peduncular article 3 not forming an opercular cap	3
2	Gnathopod 2 male subchelate	*Bathypoma* Lowry & Berents, 1996
——	Gnathopod 2 male carpochelate	*Notopoma* Lowry & Berents, 1996
3	Antenna 1 with vestigial accessory flagellum	*Runanga* J. L. Barnard, 1961
——	Antenna 1 without vestigial accessory flagellum	4
4	Pereopods 5–7 directed posteriorly	5
——	Pereopods 5 directed posteriorly, pereopods 6–7 directed anteriorly	*Paracerapus* Budnikova, 1989
5	Antenna 1 peduncular article 1 posterior margin without strong posterior projection	*Cerapus* Say, 1817
——	Antenna 1 peduncular article 1 posterior margin with strong posterior projection	*Kapalana* g. nov.

Suborder Senticaudata Lowry & Myers, 2013

Infraorder Corophiida Leach, 1814

Parvorder Caprellidira Leach, 1814

Superfamily Photoidea Boeck, 1872

Family Ischyroceridae Stebbing, 1899

Subfamily Ischyrocerinae Stebbing, 1899

Tribe Cerapodini Smith, 1880

[Further information on higher classification given in Lowry & Myers (2013) and Just (2017)]

Kapalana g. nov.

Type species. *Kapalana durraween* sp. nov., present designation.

Included species. *Kapalana* includes 8 species: *K. amelga* sp. nov.; *K. durraween* sp. nov.; *K. flindersi* (Stebbing, 1888) comb. nov.; *K. kimbla* sp. nov.; *K. maia* sp. nov.; *K. michaelmas* sp. nov.; *K. stebbingi* sp. nov.; *K. wadei* sp. nov.

Etymology. Named for the retired New South Wales Fisheries vessel FRV *Kapala*, the source of many Australian Museum fish and invertebrate collections from 1971 to 1997. The name is feminine in gender.

Diagnostic description. Head with eyes present, rostrum long to very long. **Antenna 1** without accessory flagellum; peduncular article 1 not produced anterodistally and anteromedially into an opercular cap, **posterior margin with strong subquadrate or acute posterior projection**. Antennae 1–2 peduncular articles 1–3 covered in scales [except *K. amelga*, *K. maia* and *K. flindersi*]. Gnathopod 2 carpochelate in male. Pereopod 5 propodus inserted on posterior concave side of carpus. Pereopods 5–7 directed posteriorly. Pereopods 6–7 similar, much longer than pereopod 5. Uropod 1, peduncle with distoventral fan of robust setae. Uropod 2–3 uniramous. **Tubes of juveniles attached in a ring, circling the tube of adult female** (not known for *K. flindersi*).

Remarks. *Kapalana* has the strongest similarities to *Runanga* J. L. Barnard, 1961, *Cerapus* and *Paracerapus* Budnikova, 1989. *Kapalana* differs from these genera in having a projection on the posterior margin of the first article of antenna 1 and in *Kapalana,* the juveniles attach their initial tubes to the mother tube.

The species known as *Cerapus flindersi* Stebbing, 1888 is based on a female from Flinders Passage in Torres Strait, northern Queensland. It has never been re-collected and the tube is not known. The specimen is held in The Natural History Museum, London (BMNH 89.5.15.147) and consists of four microscope slides. Based on the morphology of antenna 1 peduncular article 1, we tentatively move it to the genus *Kapalana*.

Walker & Scott (1903) reported a female from Abd al Kuri, in the Gulf of Aden that they called *Cerapus flindersi* and Chilton (1892) reported a male *Cerapus flindersi* from Port Jackson, Australia, but in both cases the species identification is dubious. Walker & Scott's specimen is poorly illustrated. Chilton's specimen lacks a projection on the posterior margin of the first article of antenna 1 and represents an undescribed species of *Cerapus*.

Kapalana amelga sp. nov.

Figs 1–3

Holotype, male, 8.8 mm, AM P.99050, south-west side of Grasshopper Island, New South Wales, Australia (35°38'01"S 150°19'51"E), hand collected on scuba, in the red alga *Peyssonnelia novaeholliandiae,* 11 m, P. B. Berents, J. Eu, A. J. Millar & G. D. F. Wilson on RV *Baragula,* 10 February 2003, Hermon Slade Batemans Bay Expedition, NSW 2038. **Paratype** female, 6.5 mm, AM P.99051, type locality, hand collected on scuba in the red alga *Amphiroa anceps,* 13 m, P. B. Berents, J. Eu, A. J. Millar & G. D. F. Wilson on RV *Baragula*, Hermon Slade Batemans Bay Expedition, 9 February 2003, NSW 2034.

Additional material examined. One female, 3 juveniles, AM P.99052, type locality, hand collected on scuba in red alga *Peyssonnelia novaeholliandiae*, 11 m, P. B. Berents, J. Eu, A. J. Millar & G. D. F. Wilson on RV *Baragula*, 10 February 2003, Hermon Slade Batemans Bay Expedition,

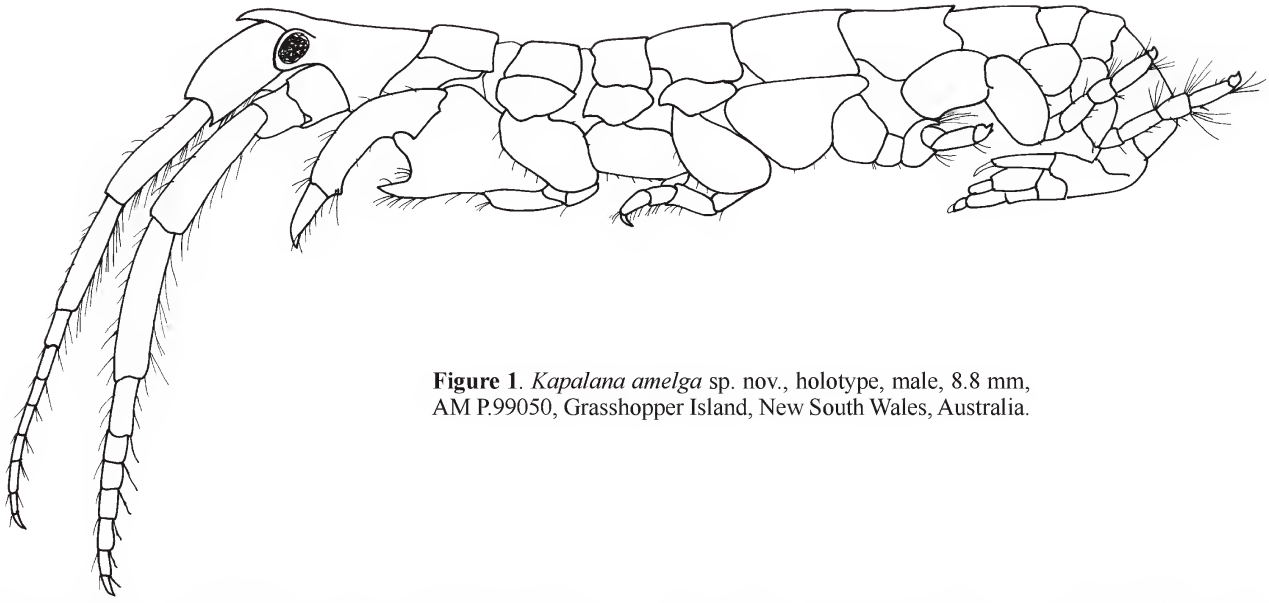


Figure 1. *Kapalana amelga* sp. nov., holotype, male, 8.8 mm, AM P.99050, Grasshopper Island, New South Wales, Australia.

NSW 2038; 1 male, 1 female, 8 juveniles, AM P.99053, type locality, hand collected on scuba in red alga *Amphiroa anceps*, 13 m, P. B. Berents, J. Eu, A. J. Millar & G. D. F. Wilson on RV *Baragula*, 9 February 2003, Hermon Slade Batemans Bay Expedition, NSW 2034; 2 males, 3 females, 1 juvenile, AM P.99054, type locality, hand collected on scuba in red alga *Amphiroa anceps,* 13 m, P. B. Berents, J. Eu, A. J. Millar & G. D. F. Wilson on RV *Baragula*, 9 February 2003, Hermon Slade Batemans Bay Expedition, NSW 2034.

Type locality. South-west side of Grasshopper Island, New South Wales, Australia (35°38'01"S 150°19'51"E).

Etymology. From the Spanish word *amelga*, meaning a ridge between two furrows and referring to the ridged posterior margin on the propodus of gnathopod 2.

Description. Based on Holotype, male, 8.8 mm, AM P.99050.

Head. Rostrum long, length 0.4 × head, evenly tapered, apically acute; lateral cephalic lobe with ventral corner subacute, subocular margin deeply recessed, reaching beyond eye, anteroventral corner subquadrate, ventral margin horizontal, posterior margin vertical. *Antenna 1* long, length 0.5 × body length; peduncle with scales; peduncular article 1 longer than article 3, length 1.2 × peduncular article 3, not produced anterodistally and anteromedially, with strong sub-quadrate projection along posterior margin, posterodistal corner not produced; peduncular article 2 anterodistal corner without distal projection; flagellum 8-articulate; article 1 short. *Antenna 2* length equal to antenna 1; flagellum 7-articulate.

Epistome and upper lip fused, produced, broad base, apically subquadrate.

Pereon. *Pereonite 1* with lateral keel, without sternal keel. *Pereonites 2–3* with sternal keel. *Pereonite 5* length 1.6 × depth.

Gnathopod 1 coxa not fused to pereonite 1, length 1.1 × depth, without anteroventral lobe; basis length 2.5 × depth; carpus broad, length 1.4 × depth with setose posterior lobe; propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.6 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.9 × breadth, without anteroproximal group of long slender setae; carpus long, length 1.3 × breadth, broad, posterior margin with row of small spines, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length 1.1 × width; propodus slender, curved, length 4.5 × width, without tooth on posterior margin, posterodistal corner smooth, with 1 tooth; dactylus length 0.5 × propodus.

Pereopod 3 coxa not fused to pereonite 3; basis length 2.2 × breadth, evenly rounded, with simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2.2 × breadth; merus length 1.1 × breadth; short; without ridges. *Pereopod 4* coxa not fused to pereonite 4, with anterior lobe separated from an anteroventral lobe; basis length 1.6 × breadth, with simple setae along entire anterior margin; ischium long, length 2.4 × breadth; merus long, length 1.6 × breadth. *Pereopod 5* coxa length 1.5 × depth, without patches of small setae, with setae along ventral margin few or absent; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 5 plumose setae; propodus with 2 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis with patch of small setae near anterior margin; merus length 1.6 × breadth; dactylus short, uncinate, with 2 accessory hooks. *Pereopod 7* coxa without posterodorsal lobe, without patch of small setae; merus length 1.4 × breadth; dactylus short, uncinate, with 2 accessory hooks.

Pleon. *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 8-articulate; outer ramus 6-articulate, article 1 evenly swollen; *Pleopod 2* inner ramus reduced, 1-articulate; outer ramus, broad, 1-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad 1-articulate. *Uropod 1* biramous; peduncle, length 1.1 × outer ramus; rami with distoventral fan of robust setae; outer ramus with lateral row of denticles, without medial setae, with 5 lateral setae, with large apical robust seta, without smaller slender setae; inner ramus length 0.5 × outer ramus, with 4–5 medial and no lateral setae, with large

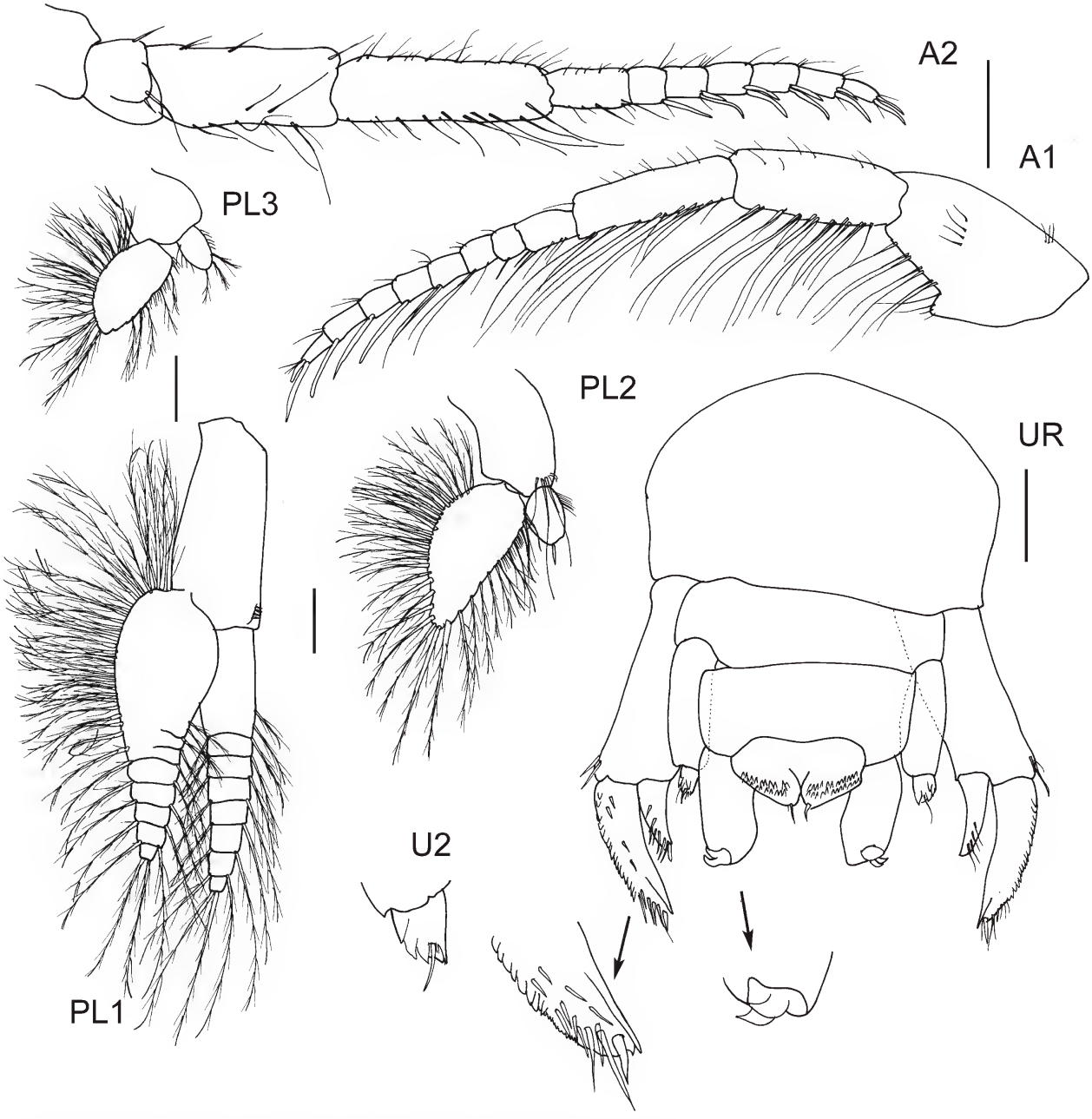


Figure 2. *Kapalana amelga* sp. nov., holotype, male, 8.8 mm, AM P.99050, Grasshopper Island, New South Wales, Australia. A1 and A2 scales, represent 0.5 mm; pleopods and urosome, scales represent 0.2 mm.

apical robust seta. *Uropod 2* uniramous, peduncle, length 2.6 × breadth, 3.8 × length of ramus; ramus small with 3 denticles and 1 slender apical seta. *Uropod 3* uniramous, peduncle length 1.9 × breadth; ramus with 2 curved hooks. *Telson* length 0.5 × breadth, weakly cleft (28 %), each lobe with 22–24 anteriorly directed hooks in 2 rows.

Female (sexually dimorphic characters). Based on paratype female, 6.5 mm, AM P.99051. *Antenna 1* peduncle without scales; flagellum 6-articulate. *Antenna 2* flagellum 6-articulate. *Pereonite 1* without lateral keel. *Pereonite 2–3* without sternal keel. *Pereonite 5,* length 2.2 × depth. *Gnathopod 1* coxa, length 1.3 × depth; basis, length 2.6 × depth; carpus length 1.6 × depth with setose posterior lobe. *Gnathopod 2* subchelate; palm extremely acute. *Pereopod 5* coxa, length 1.3 × depth. *Oostegites* from gnathopod 2 to pereopod 5.

Tube. Encrusted with detritus; tubes of juveniles attached in a ring, circling the tube of adult female.

Habitat. Sublittoral (11–13 m depth).

Remarks. *Kapalana amelga*, like *K. flindersi* and *K. maia*, lacks scales on the peduncles of antennae 1 and 2. It differs from other species in the genus in having the posterior margin of the gnathopod 2 carpus with a row of small spines and three apical denticles on the ramus of uropod 2.

Distribution. Australia. *New South Wales*: Grasshopper Island.

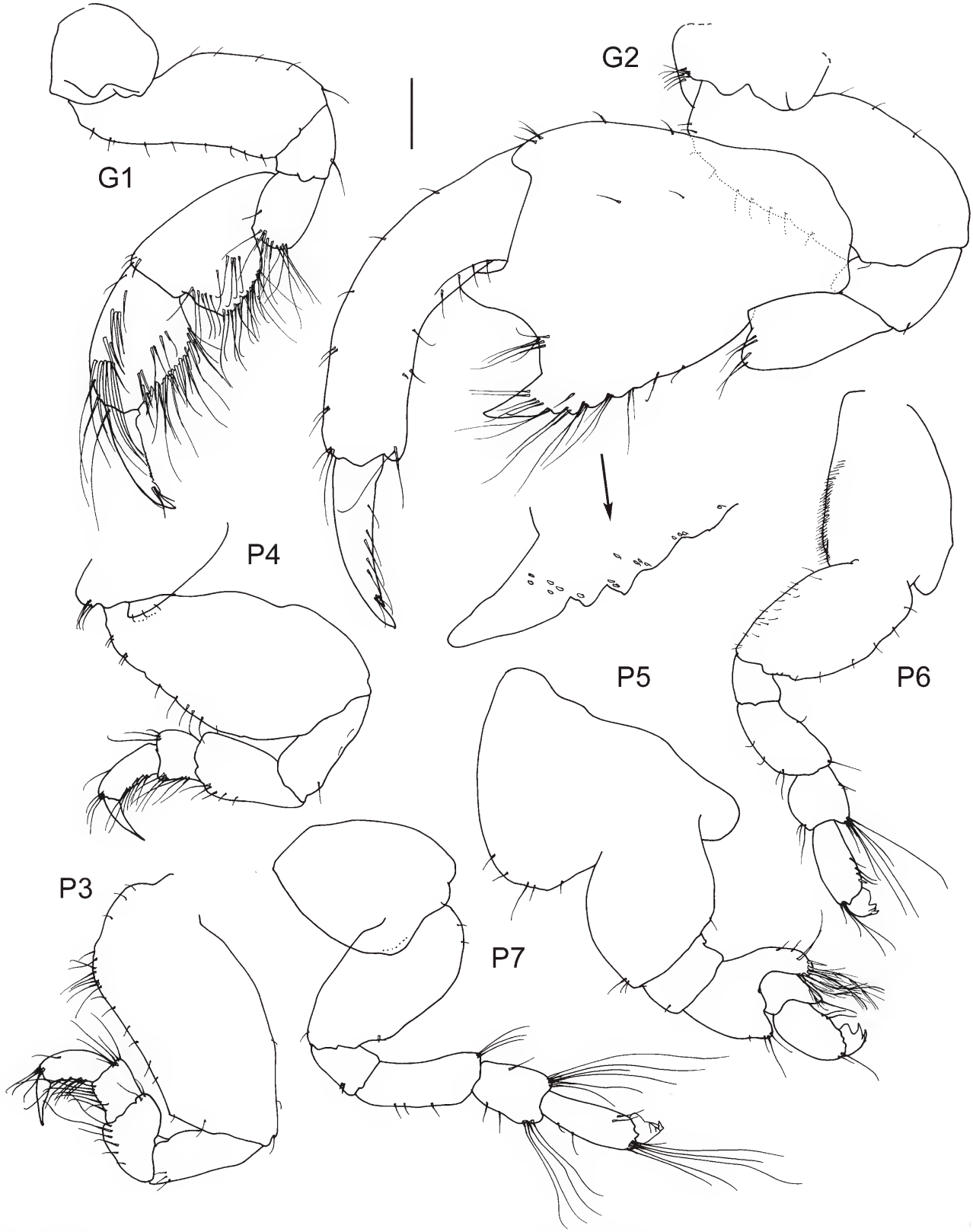


Figure 3. *Kapalana amelga* sp. nov., holotype, male, 8.8 mm, AM P.99050, Grasshopper Island, New South Wales, Australia. Scales represent 0.2 mm.

Kapalana durraween sp. nov.

Figs 4–6

Holotype, male, 9.4 mm, AM P.21868, off Disaster Bay, New South Wales, Australia (37°16'S 150°5'E), 91 m, K. Moller, May 1930. **Paratypes**: 1 male, 6.9 mm, AM P.10721, off Twofold Bay, New South Wales, Australia (37°5'S 150°9'E), 82 m, K. Moller on *Durraween*, August 1929; 1 male, 8.2 mm, AM P.76108; 1 female, 7.0 mm, AM P.76109; 4 males, 1 female, AM P.10719, off Twofold Bay, New South Wales, Australia (37°5'S 150°7'E), 82 m, K. Moller on *Durraween*, July 1929.

Additional material examined. 10 specimens, AM P.21867, 35 km east of Port Jackson, New South Wales, Australia (33°50'S 151°40'E), 366 m, 27 March 1905; 1 female, AM P.10720, west-south-west of Gabo Island, Victoria, Australia (37°34'S 149°55'E), 128 m, K. Moller on *Durraween*, December 1929; 1 female, 2 juveniles, AM P.76107, off Disaster Bay, New South Wales, Australia (37°16'S 150°5'E), 91 m K. Moller, May 1930.

Etymology. Named for the trawler *Durraween*, whose Master, Captain K. Moller, contributed many natural history specimens to the Australian Museum. Used as a noun in apposition.

Description. Based on Holotype, male 9.4 mm, AM P.21868.

Head. Rostrum long, length 0.3 × head, evenly tapered, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, anteroventral corner rounded, ventral margin horizontal, posterior margin sloping. *Antenna 1* very long, length 0.8 × body length; peduncle with scales; peduncular article 1 shorter than article 3, length 0.7 × peduncular article 3, not produced anterodistally and anteromedially, with strong sub-quadrate projection along posterior margin, posterodistal corner not produced; peduncular article 2 anterodistal corner with distal projection flagellum10-articulate; article 1 short. *Antenna 2* length equal to antenna 1; flagellum 9-articulate.

Epistome and upper lip fused, produced, broad base, apically acute.

Pereon. *Pereonite 1* with lateral keel, without sternal keel. *Pereonites 2–3* with sternal keel. *Pereonite 5* length 1.4 × depth.

Gnathopod 1 subchelate; coxa not fused to pereonite 1, without anteroventral lobe; basis length 2.1 × depth; carpus broad, length 1.5 × depth with setose posterior lobe, propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.6 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.4 × breadth, basis without anteroproximal group of long slender setae, basis without anteroproximal bulge; carpus long, length 1.2 × breadth, broad, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length 1.2 × width; propodus broad, curved, length 4.5 × width, without tooth on posterior margin, posterodistal corner smooth, without spines; dactylus length 0.4 × propodus.

Pereopod 3 coxa not fused to pereonite 3, with broad anteroventral lobe, length 1.9 × depth; basis, length 1.9 × breadth, with proximal, subquadrate anterodorsal corner, with plumose setal group and simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2 × breadth; merus length 1.1 × breadth; short; without ridges. *Pereopod 4* coxa not fused to pereonite 4, length 2.1 × depth, with anteroventral lobe; basis length 1.7 × breadth, with plumose setal group midway along anterior margin or with simple setae along entire anterior margin; ischium long, length 2.5 × breadth; merus long, length 1.4 × breadth. *Pereopod 5* coxa length 1.2 × depth, without patches of small setae, with setae along ventral margin few or absent; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 6 plumose setae; propodus with 4 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis without patch of small setae near anterior margin; merus length 1.6 × breadth; dactylus short, uncinate, with 2 accessory hooks. *Pereopod 7* coxa without posterodorsal lobe; merus length 2.1 × breadth; dactylus short, uncinate, with 2 accessory hooks.

Pleon. *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 9-articulate; outer ramus 9-articulate, article 1 evenly swollen. *Pleopod 2* inner ramus reduced, 1-articulate; outer ramus, broad, 1-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. *Uropod 1* biramous; peduncle, length 1.4 × outer ramus; rami with distoventral fan of robust setae; outer ramus with lateral row of denticles, without medial setae, with 14 lateral setae, with large apical robust seta and smaller slender setae; inner ramus length 0.5 × outer ramus, with 1 medial, and 3 lateral setae, without large apical robust seta. *Uropod 2* uniramous, peduncle, length 2.8 × breadth, 4.4 × length of ramus; ramus small with 7 denticles and 1 slender apical seta. *Uropod 3* uniramous, peduncle length 1.5 × breadth; ramus with 2 curved hooks. *Telson* length 0.6 × breadth, moderately cleft (58%), each lobe with 26–30 anteriorly directed hooks in 2 rows.

Female (sexually dimorphic characters). Based on paratype female 7.0 mm, AM P.76109. *Antenna 1* flagellum 9-articulate. *Pereonite 1* without lateral keel. *Pereonites 2–3* without sternal keel. *Pereonite 5,* length 1.9 × depth. *Gnathopod 1* coxa, length 1.1 × depth; basis, length 2 × depth; carpus length 1.3 × depth with setose posterior lobe. *Gnathopod 2* subchelate; coxa, length 1.7 × depth; basis, length 2.2 × breadth. *Pereopod 5,* coxa, length 1.4 × depth. *Oostegites* from gnathopod 2 to pereopod 5.

Tube. Tubes of juveniles attached in a ring, circling the tube of adult female.

Habitat. Continental shelf and slope (82–366 m depth).
Remarks. The shape of gnathopod 2 propodus and carpus changes as males grow, with the carpus becoming longer than wide and the propodus becoming curved and slender in large males. In males less than 7 mm, the length and breadth of the carpus are equal and the propodus is less than three times as long as wide

Three species, *K. amelga*, *K. durraween* and *K. maia*, have an evenly tapered rostrum. Neither *Kapalana durraween* nor *K. maia* have a large apical seta on the inner ramus of uropod 1. *Kapalana durraween* differs from *K. maia* in having scales on the peduncle of antenna 1, a lateral keel on pereonite 1 and a sternal keel on pereonite 3.

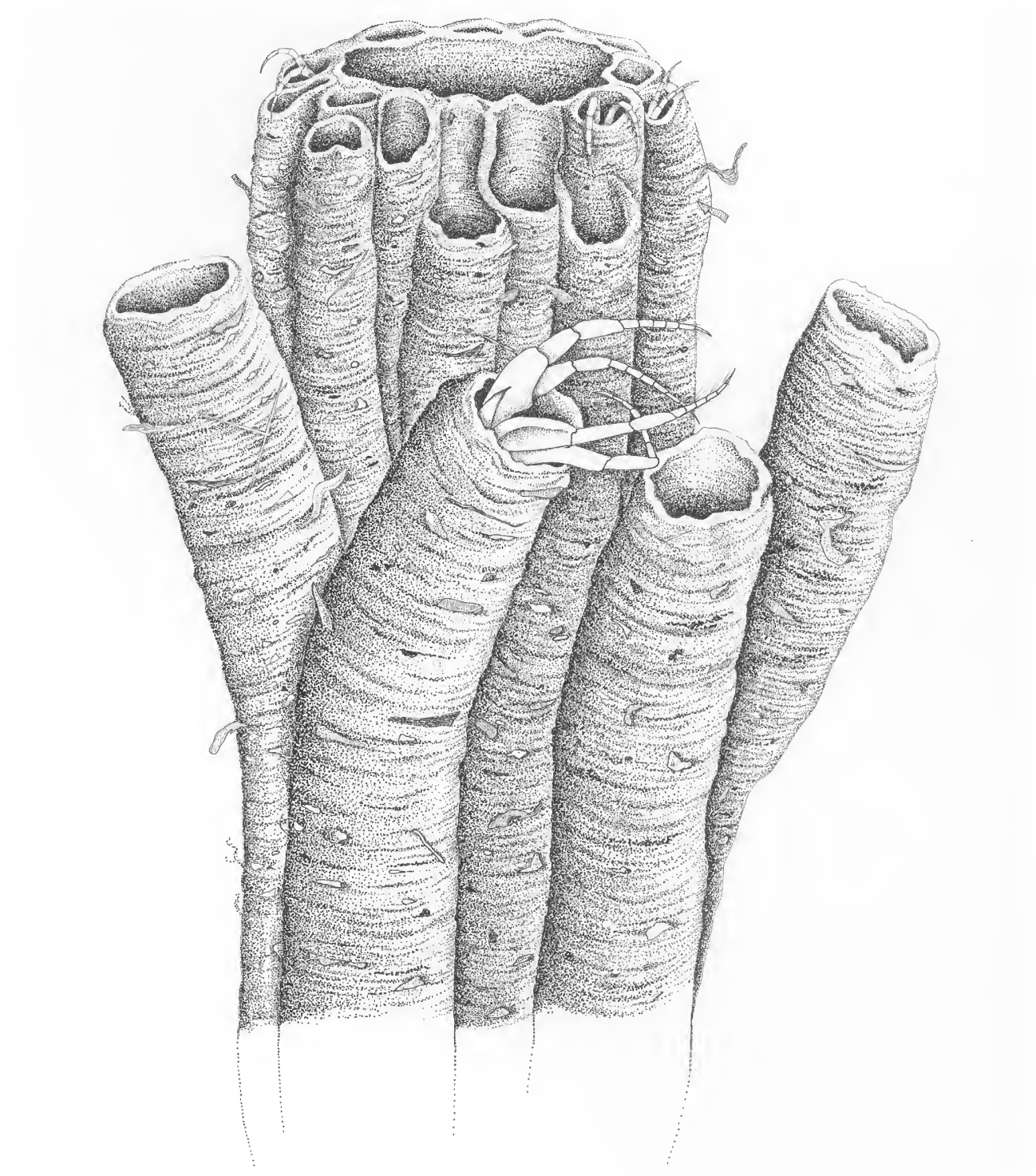


Figure 4. *Kapalana durraween* sp. nov., AM P.21867, central maternal tube with encircling juvenile tubes, 35 km east of Port Jackson, New South Wales, Australia (diameter of central tube = 2mm).

Distribution. Australia. *New South Wales*: east of Port Jackson; off Twofold Bay; off Disaster Bay. *Victoria*: west south west of Gabo Island.

Kapalana kimbla sp. nov.

Figs 7, 8

Holotype, male, 9.4 mm, MV J70496, 26 km south-west of Cape Otway, Bass Strait, Victoria, Australia (39°01'00"S 143°22'06"E), 84 m, M. F. Gomon, 31 January 1981, MV Bass Strait Survey, BSS 120 S. **Paratypes**, ovigerous female, 9.6 mm, MV J70497; male, 6.8 mm, MV J70498; male, 7.4 mm, MV J70499; male, 5.7 mm, MV J70500; male, 4.6

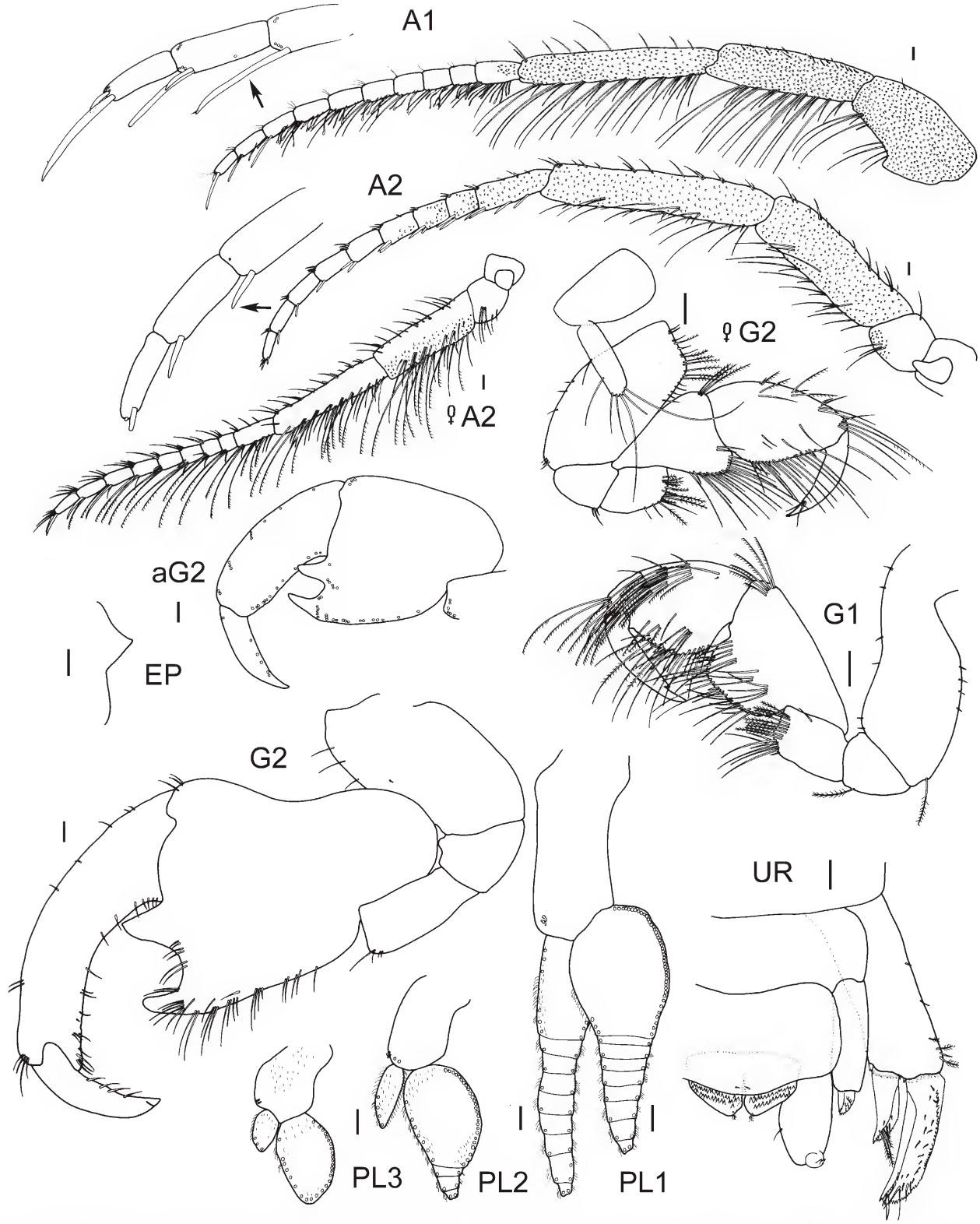


Figure 5. *Kapalana durraween* sp. nov., holotype, male, 9.4 mm, AM P.21868; paratype, female, 6.96 mm, AM P.76109; paratype male "a", 6.9 mm, AM P.10721; Disaster Bay, New South Wales, Australia. Gnathopod 2 male "a" and pleopods 1–3 insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

mm, MV J70501; male, 3.9 mm, MV J70502; same data as holotype. One female, 1 male, MV J11259, cove on south shore Leonard Point, Wilsons Promontory, Victoria, Australia, (39°01'30"S 146°17'30"E), 3 February 1982, WPNPA. One male, 1 juvenile, MV J11295, north east end Vancouver Peninsula, Western Australia, Australia, (39°03'24"S 117°56'012"E), 7 m, 8 April 1984, SWA 18. Many specimens, AM P.99049, off Venus Bay township, Venus Bay, South Australia, Australia, (33°13'48"S 134°40'06"E), sand in channel, 3 m, G. C. B. Poore, 23 April 1985, SA 85.

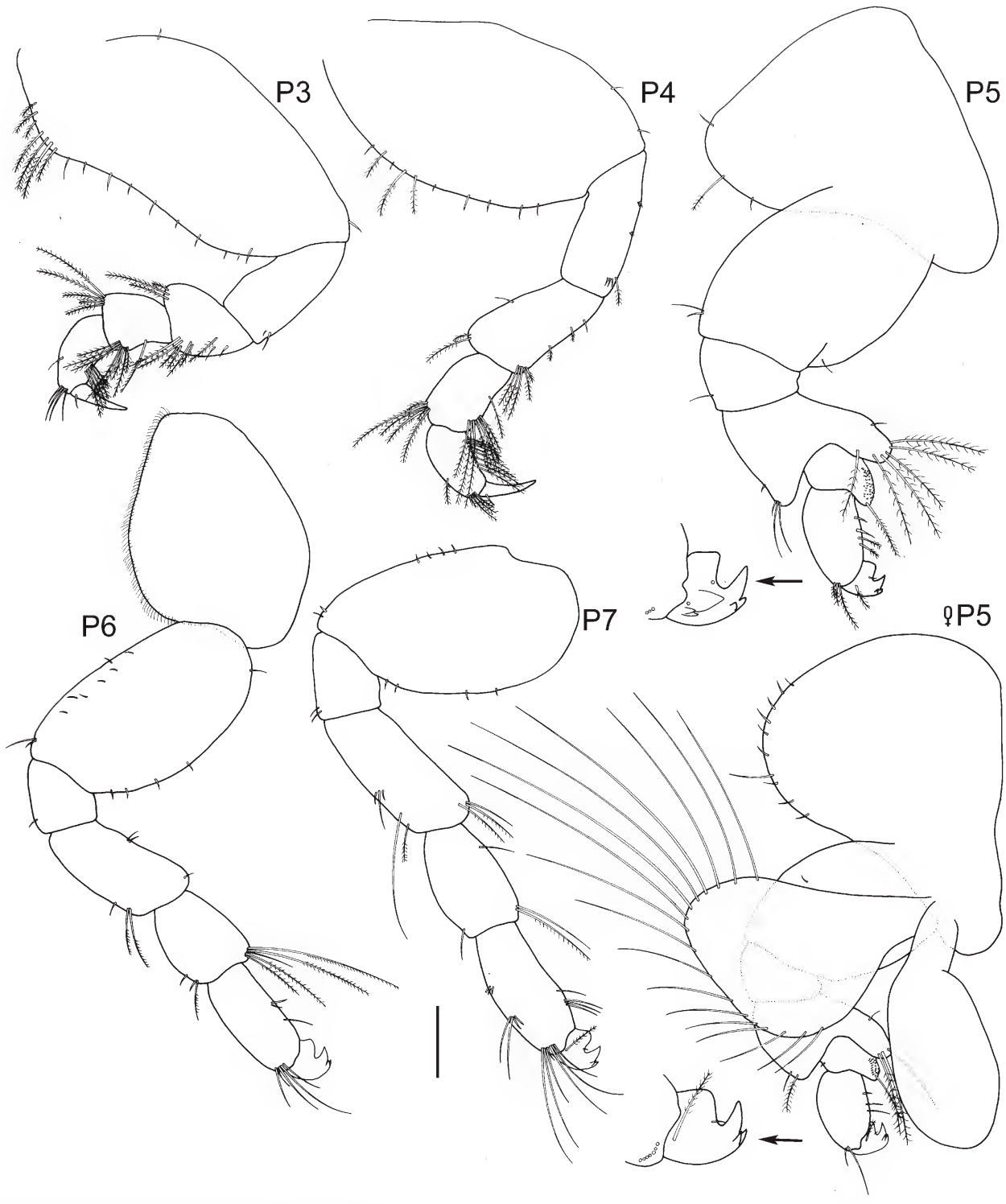


Figure 6. *Kapalana durraween* sp. nov., holotype, male, 9.4 mm, AM P.21868*;* paratype, female, 6.9 mm, AM P.76109; Disaster Bay, New South Wales, Australia. Scales represent 0.1 mm.

Additional material examined. Many specimens, MV J11297, type locality, M. F. Gomon, 31 January 1981, MV Bass Strait Survey, BSS 120 S.

Type locality. 26 km south-west of Cape Otway, Bass Strait, Victoria, Australia (39°01'00"S 143°22'06"E).

Etymology. Named for HMAS *Kimbla* in recognition of many collections made for museums in Australia by this ship. Used as a noun in apposition.

Description. Based on Holotype, male, 9.4 mm, MV J70496.

Head. Rostrum long, length 0.5 × head, forming a basal shoulder, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, anteroventral corner subquadrate, ventral margin horizontal, posterior margin vertical. *Antenna 1* long, length

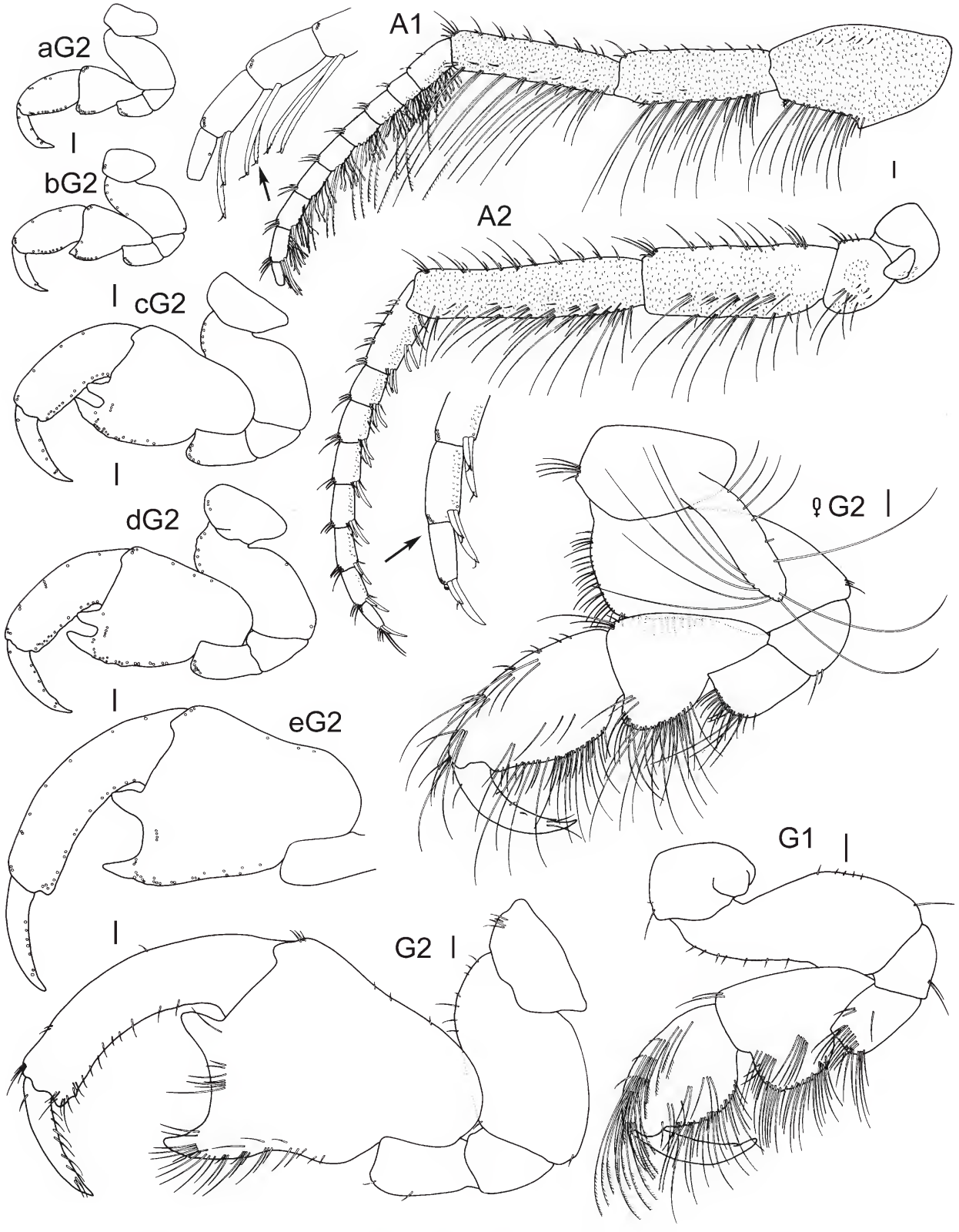


Figure 7. *Kapalana kimbla* sp. nov., holotype, male, 9.4 mm, MV J70496; paratype male "a", 3.9 mm, MV J70502; paratype, male "b", 4.6mm, MV J70501; paratype, male "c", 5.7 mm, MV J70500; paratype, male "d",6.8 mm, MV J70498; paratype, male "e",7.4 mm, MV J70499; paratype female, 9.6 mm, MV J70497; Bass Strait, Victoria, Australia. Gnathopod 2 males "a", "b", "c", "d", "e" insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

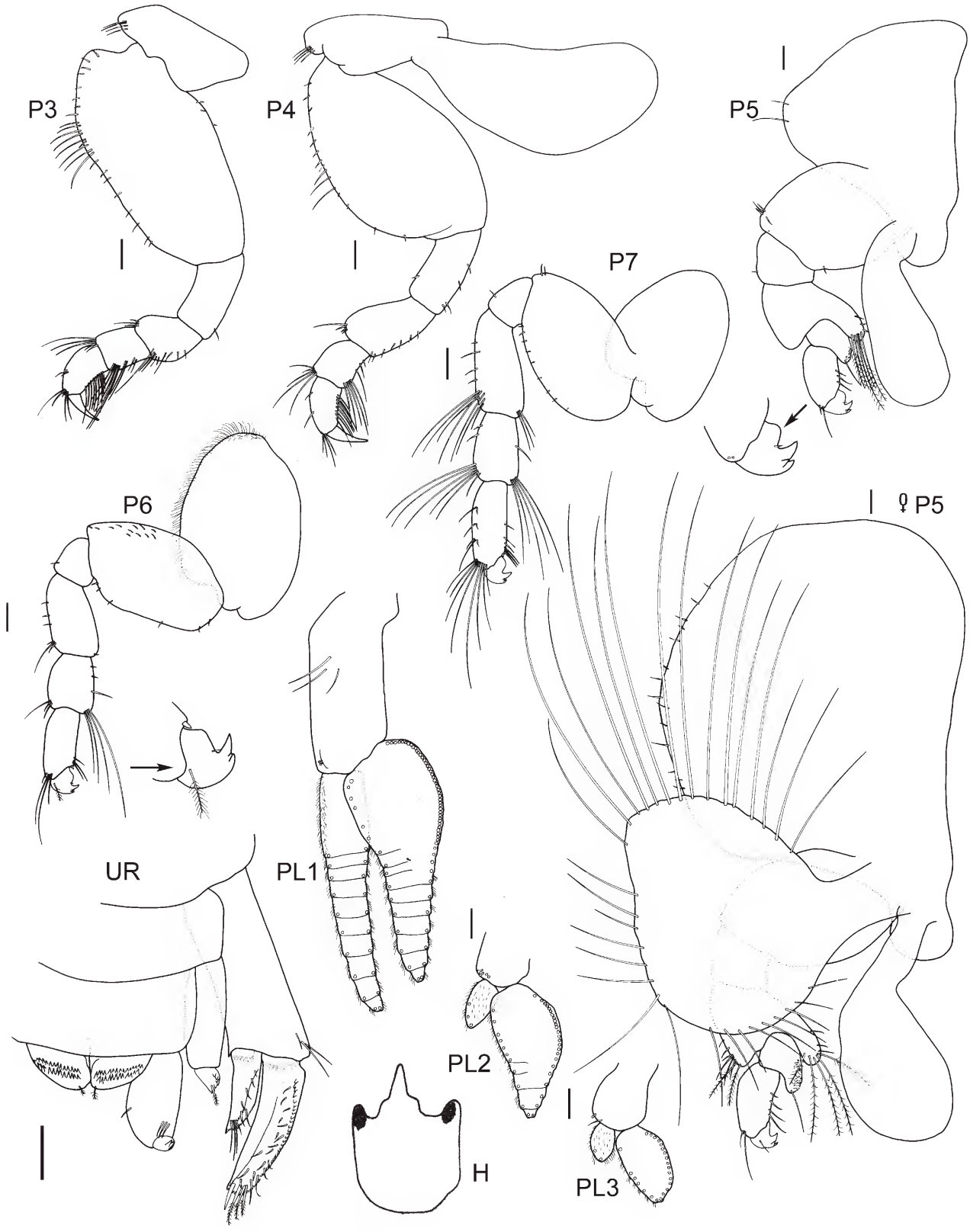


Figure 8. *Kapalana kimbla* sp. nov., holotype, male, 9.4 mm, MV J70496; paratype, female, 9.6 mm, MV J70497; Bass Strait, Victoria, Australia. Pleopods 1–3 insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

0.6 × body length; peduncle with scales; peduncular article 1 subequal to article 3, length 1.1 × peduncular article 3, not produced anterodistally and anteromedially, with strong sub-quadrate projection along posterior margin, posterodistal corner not produced; peduncular article 2 anterodistal corner without distal projection; flagellum 9-articulate; article 1 short. *Antenna 2* length 1.1 × antenna 1; flagellum 9-articulate.

Epistome and upper lip fused, produced, broad base, apically subquadrate.

Pereon. *Pereonite 1* with lateral keel. *Pereonites 1–3* with sternal keel. *Pereonite 5* length 2 × depth. *Gnathopod 1* coxa not fused to pereonite 1, length 1.4 × depth, without anteroventral lobe; basis length 2.2 × depth; carpus broad, length 1.4 × depth with setose posterior lobe, propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.8 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.4 × breadth, without anteroproximal group of long slender setae; carpus long, length 1.1 × breadth, broad, with smooth posterior margin; palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length equal to width; propodus slender, curved, length 4.9 × width, without tooth on posterior margin, posterodistal corner smooth with 1 tooth; dactylus length 0.4 × propodus.

Pereopod 3 coxa not fused to pereonite 3, without anteroventral lobe, length 1.6 × depth; basis, length 1.9 × breadth, with proximal rounded anterodorsal corner, with simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2 × breadth; merus length 1.1 × breadth, short, without ridges. *Pereopod 4* coxa not fused to pereonite 4, length 2.3 × depth, with anterior lobe separated from several small anteroventral lobes; basis, length 1.6 × breadth, with simple setal group midway along anterior margin; ischium long, length 2.4 × breadth; merus long, length 1.5 × breadth. *Pereopod 5* coxa, length 1.4 × depth, without patches of small setae, with setae along ventral margin few or absent; merus with anterior lobe not extending beyond anterior margin of carpus posterior lobe with 5 plumose setae; propodus with 3 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis with patch of small setae near anterior margin; merus length 1.7 × breadth; dactylus short, uncinate, with 2 accessory hooks. *Pereopod 7* coxa with posterodorsal lobe, without patch of small setae; merus length 2 × breadth; dactylus short, uncinate, with 2 accessory hooks.

Pleon. *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 10-articulate; outer ramus 7-articulate, article 1 evenly swollen. *Pleopod 2* inner ramus reduced, 1-articulate; outer ramus broad, 3-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. *Uropod 1* biramous; peduncle length 1.3 × outer ramus; rami with distoventral fan of robust setae; outer ramus with lateral row of denticles, without medial and lateral setae, with large apical robust seta and smaller slender setae; inner ramus, length 0.6 × outer ramus, without medial setae, with 4 lateral setae. *Uropod 2* uniramous, peduncle length 2.5 × breadth, 5 × length of ramus; ramus small with 5 denticles and 1 slender apical seta. *Uropod 3* uniramous, peduncle length 1.7 × breadth; ramus with 3 curved hooks. *Telson* length 0.6 × breadth, weakly cleft (25 %), each lobe with 26–27 anteriorly directed hooks in 2 rows.

Female (sexually dimorphic characters). Based on female 9.6 mm, MV J.11297. *Antenna 1* flagellum 10-articulate. *Antenna 2* flagellum 10-articulate. *Pereonite 1* without lateral keel. *Pereonites 1–3* without sternal keel. *Pereonite 5* length 1.5 × depth. *Gnathopod 1* basis, length 2.2 × depth; carpus length 0.7 × depth with setose posterior lobe. *Gnathopod 2* subchelate; coxa, length 1.6 × depth; basis, length 1.9 × breadth. *Pereopod 5* coxa, length 1.4 × depth. *Oostegites* from gnathopod 2 to pereopod 5.

Tube. Granular, fine or coarse grained, tubes of juveniles attached in a ring, circling the tube of adult female.

Habitat. Sub-littoral (3–84 m depth).

Remarks. The shape of gnathopod 2 propodus and carpus changes as males grow, with the propodus becoming curved and slender in large males. In males less than 5 mm in length, gnathopod 2 is subchelate and the carpus has a straight posterior margin. In males longer than 5 mm, gnathopod 2 becomes carpochelate and the carpus develops an excavate posterior margin with the excavate margin becoming shallower and wider in large males longer than 9 mm.

Kapalana kimbla and *K. amelga* both have a strong subquadrate projection along the posterior margin of peduncular article 1 of antenna 1, a large apical robust seta on the inner ramus of uropod 1 and a shallow excavate palm on gnathopod 2. They differ in a number of characters including the posterior margin of the carpus of gnathopod 2 which is smooth in *K. kimbla*, but has a row of small spines in *K. amelga*. *Kapalana kimbla* is the only species with 3 curved hooks on uropod 3.

Distribution. Australia. *Victoria:* Bass Strait; Wilsons Promontory. *South Australia*: Venus Bay.

Kapalana maia sp. nov.

Figs 9–11

Holotype, male, 10.0 mm, MV J70540, 60 km east of North Point, Flinders Island, Bass Strait, (39°41'42"S 148°39'30"E), naturalist's dredge, 115 m, 27 March 1979, G. C. B. Poore on HMAS *Kimbla*, BSS 32. **Paratypes**, female, 12.5 mm, MV J70541; 2 males, 3 females, 2 juveniles, MV J13712, same data as holotype. 1 male, 1 female, MV J11270, 63 km east of North Point, Flinders Island, Bass Strait, (39°44'48"S 148°40'36"E), WHOI epibenthic sled, 124 m, 14 November 1981, R.S. Wilson, BSS 167 S; 2 females, 2 juveniles, MV J1705, 25 km south of Cape Otway, Bass Strait, (39°06'00"S 143°35'48"E), grab, sled and trawl, 95 m, M.F. Gomon, 31 January1981, BSS 118.

Additional material examined. One female, MV J1706, 25 km south of Cape Otway, Bass Strait, (39°06'00"S 143°35'48"E), grab, sled and trawl, 95 m, M.F. Gomon, 31 January1981, BSS 118; 1 male, MV J11264 and 1 male, 2 females, 4 juveniles, MV J11257, 75 km south-south east of Port Fairy, Bass Strait, (39°01'S 142°35'E), Smith-McIntyre grab/pipe dredge, 90 m, G.C.B. Poore, 9 October 1980, BSS 63; 1 female, MV J11258, 46 km south west of Lakes Entrance, Bass Strait, (38°17'S 147°29'E), otter trawl, 29–31 m, M.F. Gomon and R.S. Wilson, 31 July 1983, BSS 211 T; 1 female, MV J11260, 52 km west north-west of Cape Farewell, King Island, Bass Strait, (39°25'S 143°23'E), Smith-McIntyre grab/pipe dredge, 103 m, G.C.B. Poore, 10 October 1980, BSS 80; 20 specimens, MV J11265, 44 km NE of Cape Wickham, King Island, Bass Strait, (39°22'00"S 144°18'18"E), grab, sled and trawl, 60 m, R.S. Wilson, 23 November 1981, BSS 203; 1 female, MV J11267, 80 km west south-west of Cape

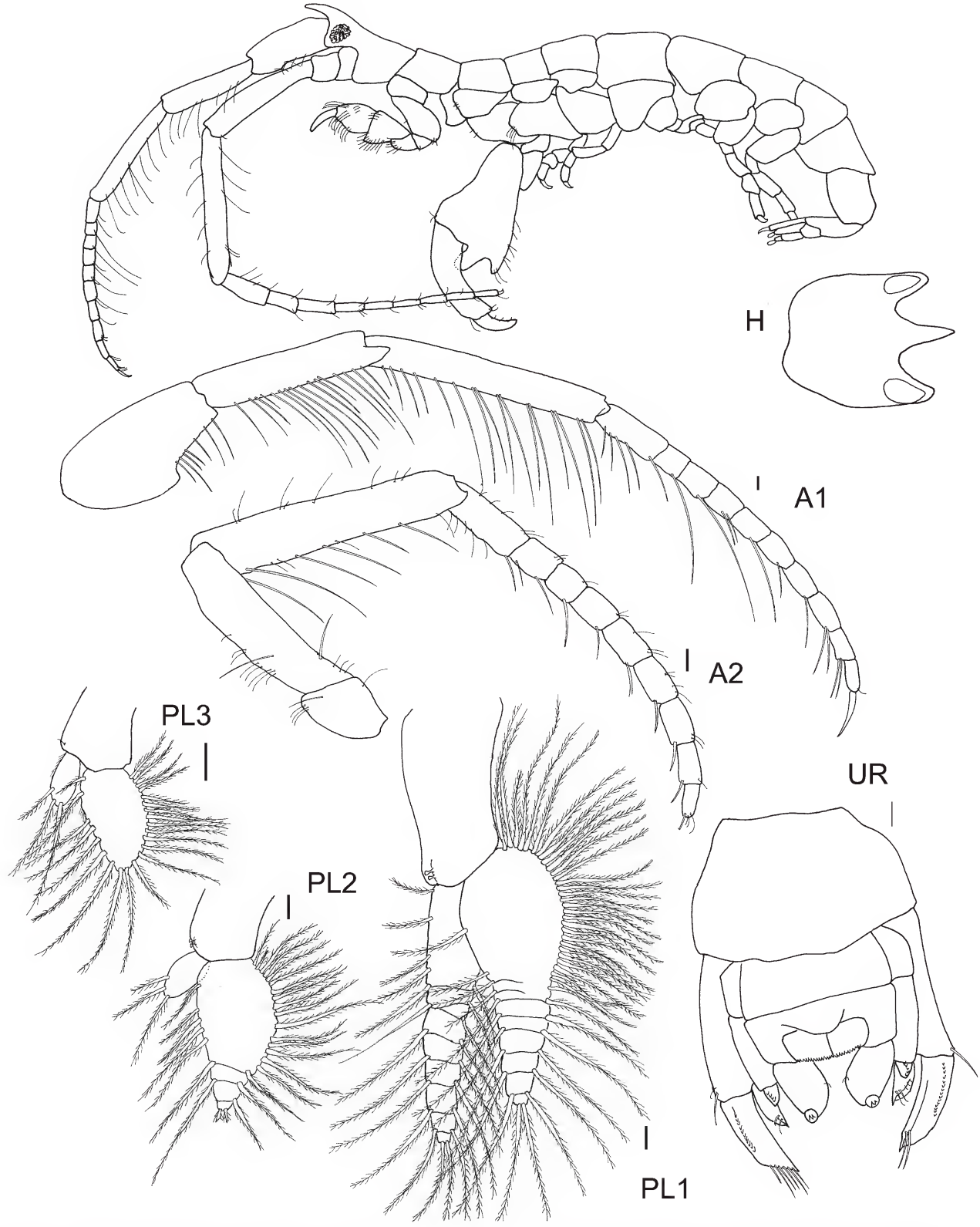


Figure 9. *Kapalana maia* sp. nov., holotype, male, 10.0 mm, MV J70540, Bass Strait, Victoria, Australia. Scales represent 0.1 mm.

Otway, Bass Strait, (39°59'S 142°37'E), Smith-McIntyre grab/pipe dredge, 94 m, G.C.B. Poore, 9 October 1980, BSS 62; 1 male, MV J11291, 79 km south south-east of Port Fairy, Bass Strait, (39°02'S 142°38'E), Smith-McIntyre grab/pipe dredge, 119m, G.C.B. Poore, 9 October 1980, BSS 64; 1 male, 2 females, MV J11292, 15 km south of Cape Wellington, Wilsons Promontory, Bass Strait (39°03'12"S 146°39'30"E), 55 m, WHOI epibenthic sled, R.S. Wilson, 18 November 1981, BSS 179 S; 1 male, MV J11519, off Crib Point, Western Port, Victoria (38°20'56"S 145°13'20"E), Smith-McIntyre grab, 8 m, A.J. Gilmour, 29 March 1965, CPBS-N; 6 specimens, MV J13710, 60 km east of North

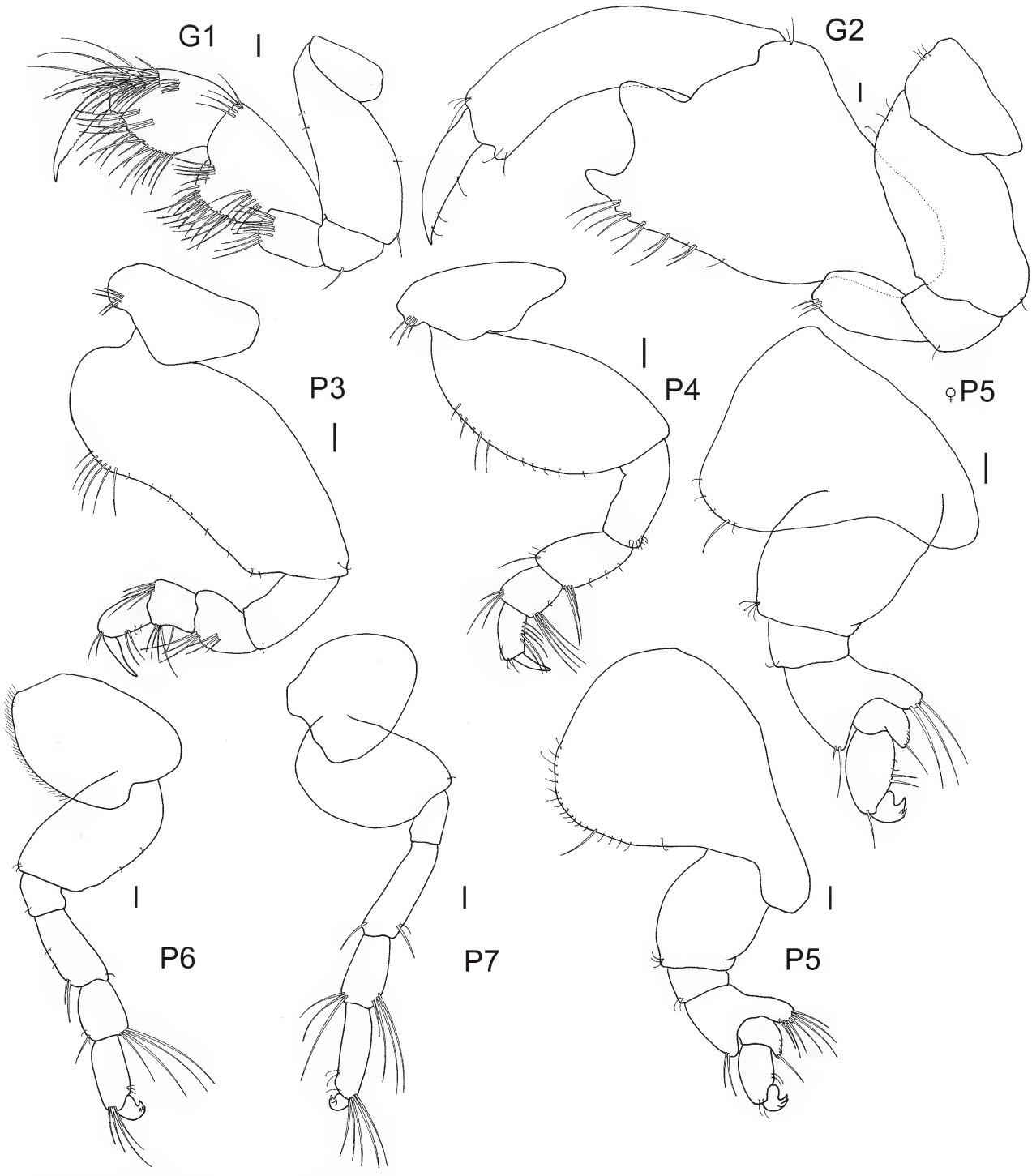


Figure 10. *Kapalana maia* sp. nov., holotype, male, 10.0 mm, MV J70540; paratype, female, 12.5 mm, MV J70541; Bass Strait, Victoria, Australia. Scales represent 0.1 mm.

Point, Flinders Island, Bass Strait, (39°41'42"S 148°39'30"E), naturalist's dredge, 115 m, G.C.B. Poore, 27 March 1979, BSS 32; 1 female, 200 m west of Kinghorne Point, Woodbridge, Tasmania, (43°10'00"S 147°17'00"E), pipe dredge, 27 m, R.S. Wilson, 17 April 1985, TAS 5; 1 female, MV J70505, 30 km north of North Point, Flinders Island, Bass Strait, (39°26'18"S 144°18'18"E), grab, sled and trawl, 49 m, R.S. Wilson, 17 November 1981, BSS 173; 1 female, AM P.99055, south east of Lakes Entrance, Bass Strait, (38°08'50"S 148°35'00"E), sandy clay, 146 m, C. Phipps on *Esso Gipps*, 5–7 May 1969, Stn. 9; 3 males, AM P.99056, 65 km south of Cape Schanck, Bass Strait (39°08'18"S 144°43'54"E), coarse sand, 66 m, R.S. Wilson on RV *Tangaroa*, 23 November 1981, BSS 201; 2 males, 1 female, 1 juvenile, AM P.99057, 23 km east of Cape Rochon, Three Hummock Island, Bass Strait (40°22'12"S 145°17'00"E), sand, epibenthic sled, 40 m, M.F. Gomon and G.C.B. Poore on RV *Sarda*, 3 November 1980, BSS 112.

Type locality. 60 km east of North Point, Flinders Island, Bass Strait, (39°41'42"S 148°39'30"E).

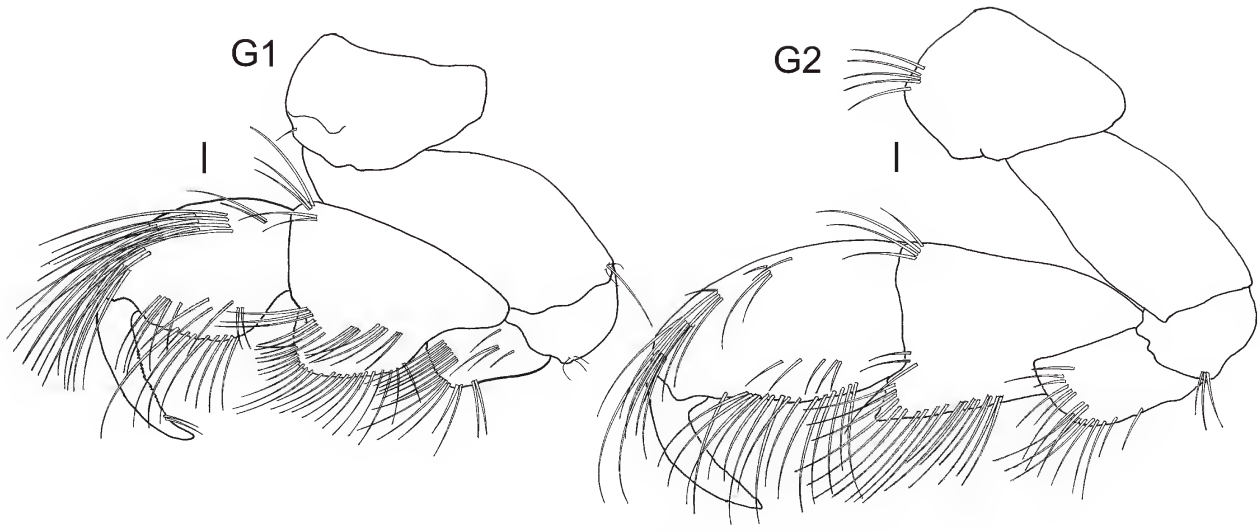


Figure 11. *Kapalana maia* sp. nov., paratype, female, 12.5 mm, MV J70541; Bass Strait, Victoria, Australia. Scales represent 0.1 mm.

Etymology. The species name is derived from the Greek *maia*, meaning "good mother", in reference to the juveniles living in tubes which are attached to the female tube.

Description. Based on Holotype, male, 10.0 mm, MV J70540. **Head**. Rostrum long, length 0.4 × head, evenly tapered, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, anteroventral corner rounded, ventral margin sloping. *Antenna 1* very long, length 0.8 × body length; peduncle without scales; peduncular article 1 shorter than peduncular article 3, length 0.7 × peduncular article 3; peduncular article 2 with medial triangular projection; flagellum 10-articulate; article 1 long. *Antenna 2* length equal to antenna 1; flagellum 9-articulate.

Epistome and upper lip fused, produced, broad base, apically acute.

Pereon. *Pereonite 1* without lateral keel or sternal keel. *Pereonite 2* with sternal keel. *Pereonite 3* without sternal keel. *Pereonite 5* length 1.3 × depth.

Gnathopod 1 coxa not fused to pereonite 1, length 2.2 × depth, without anteroventral lobe; basis, length 2.3 × depth; carpus broad, length 1.4 × depth with setose posterior lobe; propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.5 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.6 × breadth; carpus long, length 1.2 × breadth, broad, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length 1.1 × width; propodus broad, curved, length 4 × width, without tooth on posterior margin, posterodistal corner smooth, with 1 tooth; dactylus length 0.4 × propodus.

Pereopod 3 coxa not fused to pereonite 3, with broad anteroventral lobe, length 1.8 × depth; basis, length 1.8 × breadth, evenly rounded, with simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2.3 × breadth; merus length 1.1 × breadth, short, without ridges. *Pereopod 4* coxa not fused to pereonite 4, length 2.4 × depth, with anterior lobe separated from an anteroventral lobe; basis, length 1.9 × breadth, with simple setal group midway along anterior margin; ischium long, length 2.5 × breadth; merus long, length 1.3 × breadth. *Pereopod 5* coxa, length 1.3 × depth, without patches of small setae; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 3 plumose setae; propodus with 2 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis without patch of small setae near anterior margin; merus length 2 × breadth; dactylus short, uncinate, with 2 accessory hooks. *Pereopod 7* coxa without posterodorsal lobe, without patch of small setae; merus length 2.5 × breadth; dactylus short, uncinate, with 2 accessory hooks.

Pleon. *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 9-articulate; outer ramus 8-articulate, article 1 evenly swollen. *Pleopod 2* inner ramus reduced, 1-articulate; outer ramus broad, 4-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. *Uropod 1* biramous; peduncle, length 1.5 × outer ramus; rami with distoventral fan of robust setae; outer ramus with lateral row of denticles, with 2 medial setae, lateral setae absent, with large apical robust seta and smaller slender setae; inner ramus, length 0.5 × outer ramus, with 6 medial, and 5 lateral setae, without large apical robust seta. *Uropod 2* uniramous, peduncle, length 3 × breadth, 5.1 × length of ramus; ramus small with 7 denticles and 1 slender apical seta. *Uropod 3* uniramous, peduncle length 1.8 × breadth; ramus with 2 curved hooks. *Telson* length 0.7 × breadth, weakly cleft (27 %), each lobe with 28–29 anteriorly directed hooks in 2 rows.

Female (sexually dimorphic characters). Based on paratype female 12.5 mm, MV J.70541. *Antenna 1* flagellum 11-articulate. Ant*enna 2* flagellum 10-articulate. *Pereonite 2* without sternal keel. *Gnathopod 1* carpus length 1.3 × depth with setose posterior lobe. *Gnathopod 2* subchelate, basis, length 1.8 × breadth. *Oostegites* from gnathopod 2 to pereopod 5.

Tube. Encrusted with fine sediment; tubes of juveniles attached in a ring, circling the tube of adult female.

Remarks. *Kapalana maia* belongs to the species group with a subquadrate projection along the posterior margin of peduncular article 1 of antenna 1. It shares with *K. durraween*, *K. michaelmas* and *K. wadei* a lack of apical robust seta on the inner ramus of uropod 1. It shares with *K. durraween* and *K. wadei* an anterodistal projection on peduncular article 2, but in *K. maia* the projection is triangular and more pronounced. It has an evenly tapered rostrum similar to *K. durraween*. *Kapalana maia* has no lateral keel on pereonite 1 or sternal keel on pereonite 3 (both present in *K. durraween*). The tubes of *K. maia* are encrusted with fine sediment (encrusted with sand grains and pieces of shell in *K. durraween*).

Distribution. Australia. *Victoria:* Bass Strait; Wilsons Promontory. *Tasmania*: Bass Strait; King Island; Flinders Island; Woodbridge.

Kapalana michaelmas sp. nov.

Figs 12–15

Holotype, male, 10.3 mm, AM P.75528, off south-east corner of Michaelmas Island, King George Sound, Western Australia, Australia (35°3'S 118°E), sand, 27 m, J. K. Lowry, 17 December 1983, WA 187. **Paratypes**: 1 female, 10.0 mm, AM P.75529; 1 male, 5.7 mm, AM P.75530; 1 male, 5.4 mm, AM P.75531; 1 male, 6.5 mm, AM P.75532; 1 male, 7.5 mm, AM P.75533; 1 male, 8.9 mm, AM P.75534; many specimens, AM P.75535; 1 specimen, AM P.75538; collection data same as holotype.

Additional material examined. One female, AM P.75536, near Mistaken Island, Vancouver Peninsula, King George Sound, Western Australia (35°4'S 117°56'E), seagrass, 6 m, R. T. Springthorpe, 13 December 1983, WA 121; 2 females, AM P.75537, near Mistaken Island, Vancouver Peninsular, King George Sound, Western Australia (25°4'S 117°56'E), seagrass, 3 m, J. K. Lowry, 13 December 1983, WA 112; 1 male, 6.2 mm, 1 female, 8.3 mm, 1 male, 20 females, SAM C1755, 6 miles off Semaphore, South Australia (34.837°S 138.484°E), 5 fathoms, H.M. Hale, 12 December 1925; 2 females, SAM C6341, 2 nautical miles south west of Point Avoid, Price Island, Eyre Peninsula, South Australia (35°42'S 135°19'E), shale gutters and algae, 17 m, L. Hobbs on MRV *Ngerin*, 28 September 1989; females & juveniles, SAM C6342, West Island, South Australia (35°37'S 138°35'E), 5 m, S. A. Shepherd, 20 June 1989; many specimens, AM P.99047, Cape Donington, Spencer Gulf, South Australia, (34° 44'S 135°59'E), rough bottom, 15 m, N. Coleman, 21 December 1970; 1 male, 1 female, 1 juvenile, AM P.99048, reef front, south of Tantabiddy, Ningaloo Reef, Western Australia, (21°54'36"S 113°55'42"E), coral heads, 9 m, N. L. Bruce and M. Blazewicz-Paszkowycz, 12 June 2008, NIN 10c.

Type locality. Off south-east corner of Michaelmas Island, King George Sound, Western Australia, Australia (35°3'S 118°E).

Etymology. Named for Michaelmas Island, the type locality. Used as a noun in apposition.

Description. Based on Holotype, male, 10.3 mm, AM P.75528.

Head. Rostrum long, length 0.5 × head, forming a basal shoulder, apically acute; lateral cephalic lobe with ventral corner subacute, subocular margin deeply recessed, reaching beyond eye, anteroventral corner rounded, ventral margin sloping, posterior margin sloping. *Antenna 1* long, length 0.5 × body length; peduncle with scales; peduncular article 1 subequal in length to peduncular article 3, length 1.1 × peduncular article 3, with well-developed subquadrate projection along posterior margin; peduncular article 2 with distal projection; article 2 anterodistal corner without distal projection; flagellum 9-articulate; article 1 short. *Antenna 2* length 0.9 × antenna 1; flagellum 10-articulate.

Epistome and upper lip fused, produced, broad base, apically acute. *Mandible* palp article 2 long and slender (more than 2.5 × as long as broad); palp article 3 slender, blade-like.

Pereon. *Pereonite 1* with lateral keel, without sternal keel. *Pereonites 2–3* without sternal keel. *Pereonite 5* length equal to depth.

Gnathopod 1 subchelate; coxa not fused to pereonite 1, length 1.2 × depth, without anteroventral lobe; basis length 2.3 × depth; carpus broad, length 1.5 × depth with setose posterior lobe, propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.6 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.8 × breadth; carpus long, length 1.3 × breadth, broad, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, medium length, length 0.9 × width; propodus slender, curved, length 4.8 × width, without tooth on posterior margin, posterodistal corner smooth, without spines; dactylus length 0.5 × propodus.

Pereopod 3 coxa not fused to pereonite 3, without anteroventral lobe, length 2.3 × depth; basis, length 2.1 × breadth, with proximal, subquadrate anterodorsal corner, with plumose setal group and simple setae along anterior margin, without denticles along anterior margin; ischium long, length 2.3 × breadth; merus length equal to breadth, short; without ridges. *Pereopod 4* coxa not fused to pereonite 4, length 2 × depth, with anterior lobe separated from an anteroventral lobe; basis length 1.7 × breadth, with simple setae along entire anterior margin; ischium long, length 2.9 × breadth; merus very long, length 1.5 × breadth. *Pereopod 5* coxa, length 1.3 × depth, without patches of small setae, with setae along ventral margin few or absent; merus with anterior lobe not extending beyond anterior margin of carpus, posterior lobe with 2 plumose setae; propodus with 4 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis with patch of small setae near anterior margin; merus length 2 × breadth; dactylus short, uncinate, with 2 accessory hooks. *Pereopod 7* coxa without posterodorsal lobe, without patch of small setae; merus length 2.4 × breadth; dactylus short, uncinate, with 2 accessory hooks.

Pleon. *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 9-articulate; outer ramus 6-articulate, article 1 evenly swollen. *Pleopod 2* inner ramus reduced, 1-articulate; outer ramus, broad, 3-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. *Uropod 1* biramous; peduncle, length 1.4 × outer ramus; rami with distoventral fan of robust setae;

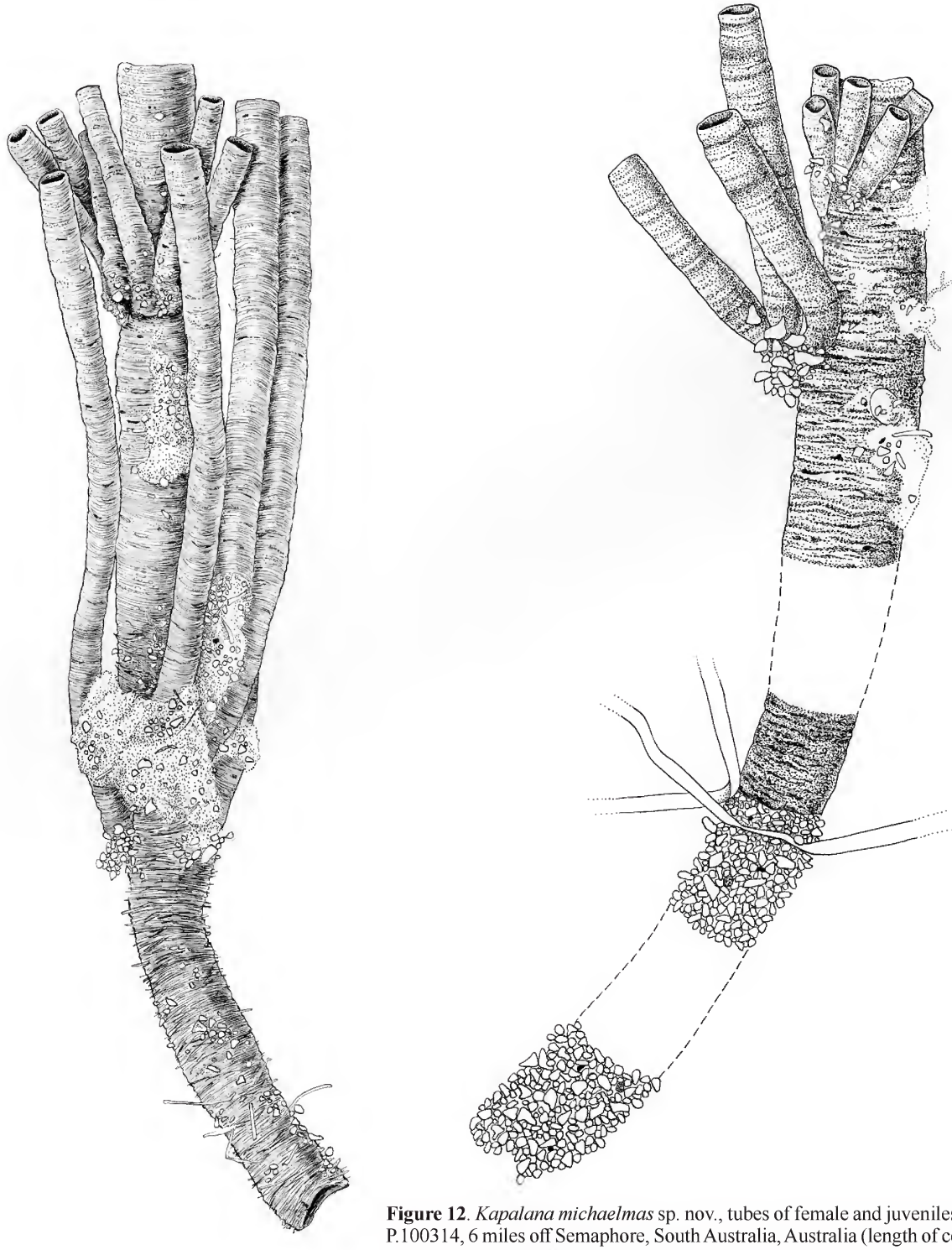


Figure 12. *Kapalana michaelmas* sp. nov., tubes of female and juveniles; left, AM P.100314, 6 miles off Semaphore, South Australia, Australia (length of central tube = 30 mm); right, AM P.75535, Michaelmas Island, King George Sound, Western Australia, Australia (length of tube = 70 mm).

outer ramus with lateral row of denticles, with 6 medial setae and 18 lateral setae, with large apical robust seta and smaller slender setae; inner ramus, length 0.6 × outer ramus, with 6 medial, and 4 lateral setae, without large apical robust seta. *Uropod 2* uniramous, peduncle, length 2.9 × breadth, 3.7 × length of ramus; ramus small with 7 denticles and 1 slender apical seta. *Uropod 3* uniramous, peduncle length 1.9 × breadth; ramus with 2 curved hooks. *Telson* length 0.6 × breadth, moderately cleft (21 %), each lobe with 38–39 anteriorly directed hooks in 2 rows.

Female (sexually dimorphic characters). Based on female, 10.0 mm, AM P.75529. *Antenna 1* flagellum 10-articulate. Antenna 2 flagellum 7-articulate. *Pereonite 1* without lateral keel. *Gnathopod 1* coxa, length 1.4 × depth; basis, length 2.6 × depth, carpus length 0.7 × depth with setose posterior lobe. *Gnathopod 2* simple; basis, broad, length 1.9 × breadth, carpus length 1.7 × breadth. *Pereopod 5* coxa, length 1.4 × depth. *Oostegites* from gnathopod 2 to pereopod 5.

Tube. Tubes of adult males encrusted with fine and coarse organic matter. Tubes of adult females in two parts, the

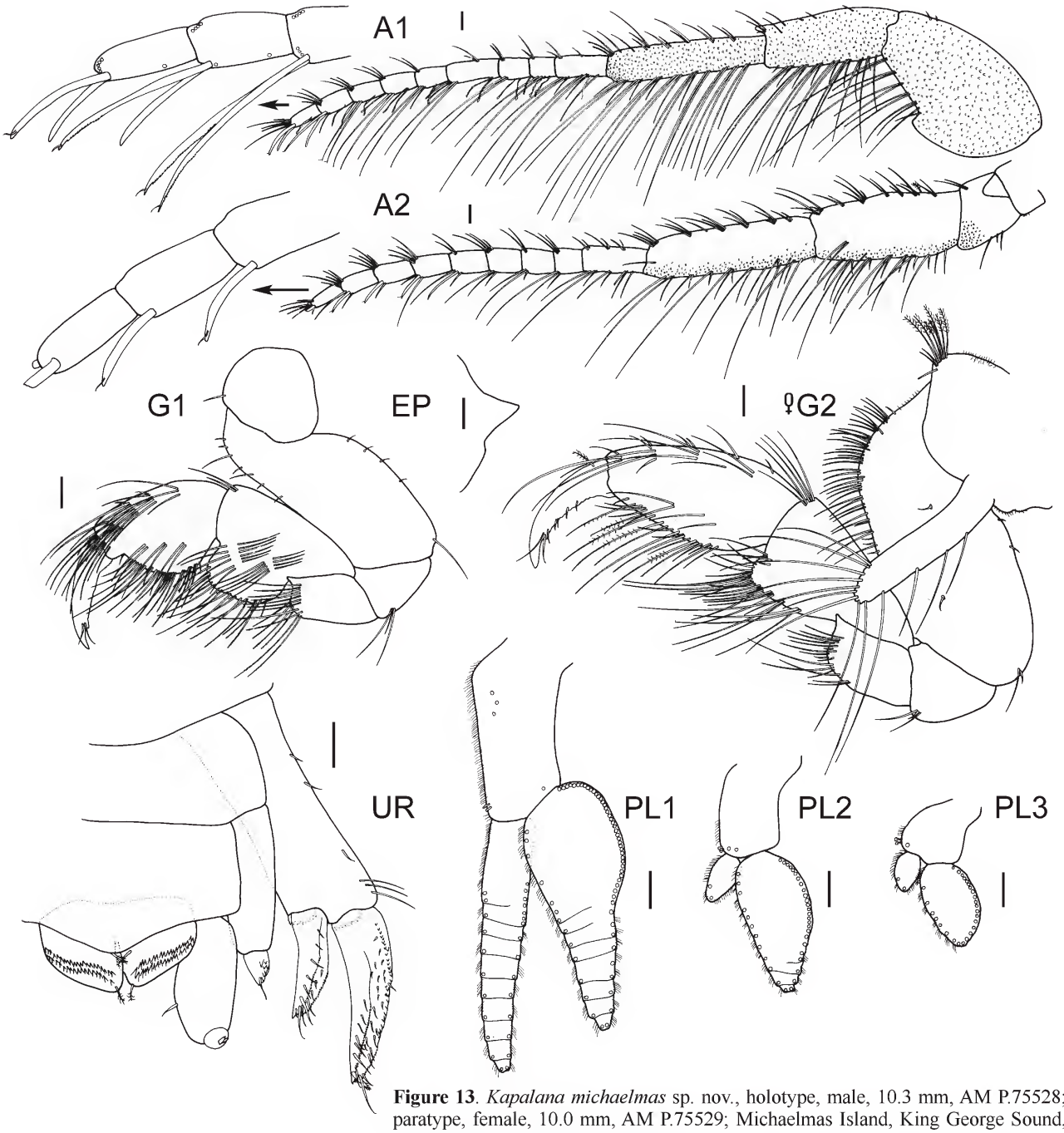


Figure 13. *Kapalana michaelmas* sp. nov., holotype, male, 10.3 mm, AM P.75528; paratype, female, 10.0 mm, AM P.75529; Michaelmas Island, King George Sound, Western Australia, Australia. Pleopods 1–3 insertion points of setae are indicated by small circles. Scales represent 0.1 mm

anterior end encrusted with fine and coarse organic matter, the posterior end encrusted with large sand grains. Tubes of juveniles attached in a ring, circling the tube of adult female.

Habitat. Sublittoral (3–27 m depth).

Remarks. The shape of gnathopod 2 propodus and carpus changes as males grow, with the propodus becoming curved and slender in large males. In males less than 6 mm in length, gnathopod 2 is subchelate with a small anterodistal and posterodistal tooth. In males longer than 6 mm, gnathopod 2 becomes carpochelate, and the carpus develops an excavate posterior margin.

Kapalana michaelmas shares with *K. durraween*, *K. maia* and *K. wadei* a lack of apical robust seta on the inner ramus of uropod 1. The rostrum has a basal shoulder (a character shared with *K. kimbla* and *K. wadei*) but the rostrum is not as long as *K. wadei* (the rostrum is very long in *K. wadei*). Gnathopod 1 coxa is not fused to pereonite 1 in *K. michaelmas* (fused in *K. wadei*). In *K. michaelmas* the posterior lobe of the carpus of pereopod 5 bears 2 plumose setae and *K. wadei* bears 6 plumose setae.

Distribution. Australia. *Western Australia:* King George Sound; Ningaloo Reef. *South Australia*: off Semaphore; Price Island, Eyre Peninsula; West Island; Cape Donington, Spencer Gulf.

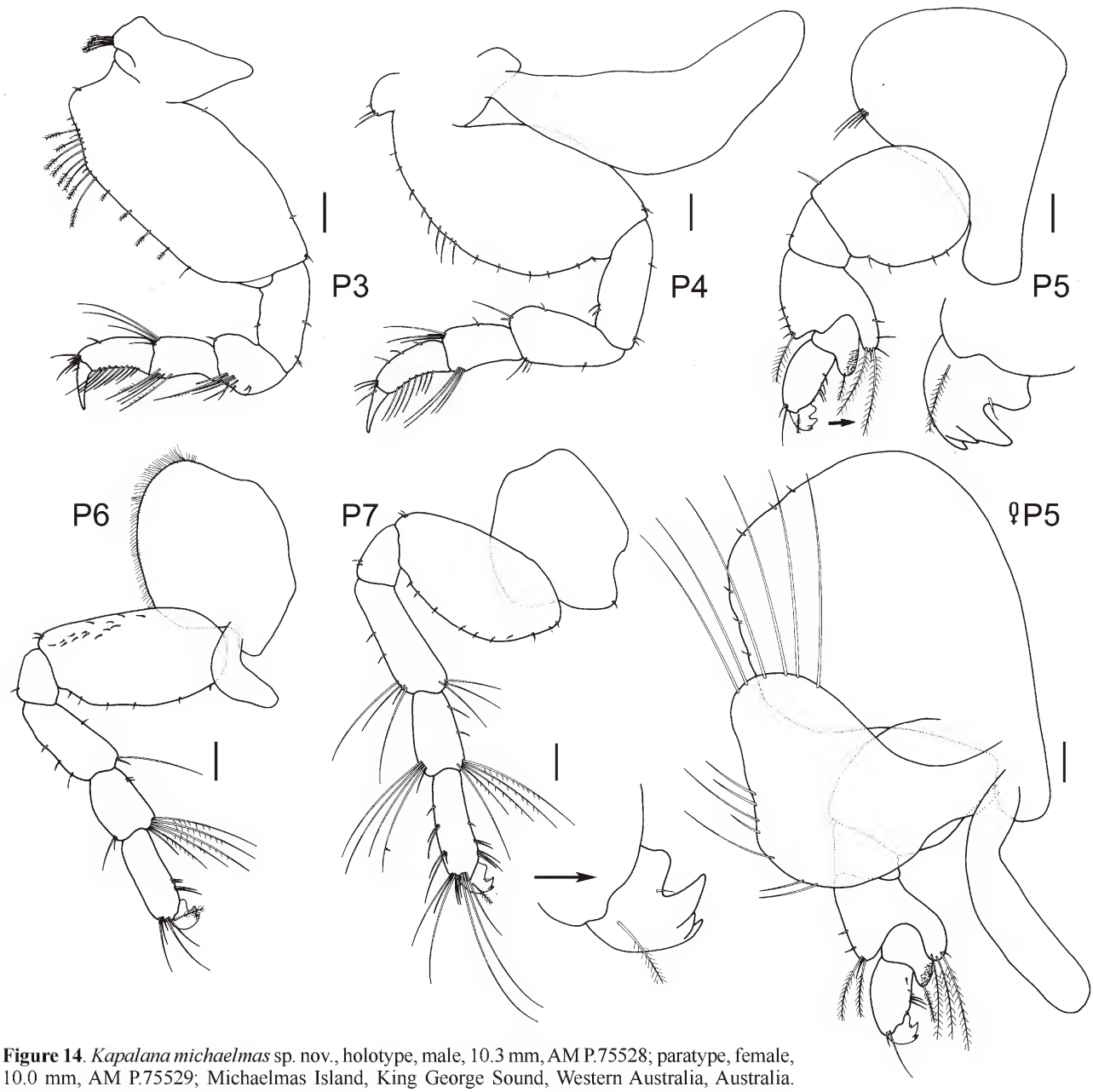


Figure 14. *Kapalana michaelmas* sp. nov., holotype, male, 10.3 mm, AM P.75528; paratype, female, 10.0 mm, AM P.75529; Michaelmas Island, King George Sound, Western Australia, Australia. Scales represent 0.1 mm

Kapalana stebbingi sp. nov.

Figs 16–19

Cerapus abditus.—Stebbing, 1910: 616, pl. 5a.

Holotype, male, 8.9 mm, AM P.51210, east of Port Jackson, New South Wales, Australia (33°52'S 151°23'E), mud, 80 m, FRV *Kapala*, 27 October 1980, stn K-80-20-11. **Paratypes**: 1 female, ovigerous, 6.4 mm, AM P.51211; 1 male, 6.5 mm, AM P.99058; 1 male, 5.7 mm, AM P.99059; 1 male, 4.9 mm, AM P.99060; many specimens, AM P.99061; all same data as holotype. Many specimens, AM P.99062, south-east of Broken Bay, New South Wales, Australia, (33°36'S 151°30'E), trawl, 71–75 m, FRV *Kapala*, 10 February 1986, K86-01-02; 1 male, 1 female, MV J17211, south of Point Hicks, Victoria, Australia (38°14'48"S 149°09'18"E), WHOI epibenthic sled, 200 m, M.F. Gomon, 24 July 1986, Slope 41.

Additional material. Many specimens, AM P.99063, south-east of Broken Bay, New South Wales, Australia, (33°36'S 151°30'E), trawl, 71–75 m, FRV *Kapala,* 10 February 1986; 1 female, AM P.2526; 1 male, 1 female, AM P.2527; 3–4 km off Botany Bay, New South Wales, Australia, (34°05'S 151°15'E), mud, 91–95 m, E.R. Waite on HMCS *Thetis,* 11 March 1898, stn 37. 1 male, AM P.2528, 9–12 km off Cape Three Points, New South Wales, Australia, (33°32'S 151°32'30"E), trawl, sticky mud and shell, 75–91 m, E.R. Waite on HMCS *Thetis*, 25 February 1898, stn 13; 1 male, AM P.99064, east of Broken Bay, New South Wales, Australia, (33°35'S 151°41'E), 135 m, FRV *Kapala*, 10 February 1986, K86-01-03; 2 specimens, AM P.99065, east of Long Reef Point, New South Wales, Australia, (33°46'S 151°43'E), dredge, 176 m, FRV *Kapala*, 5 December 1977, K77-23-01.

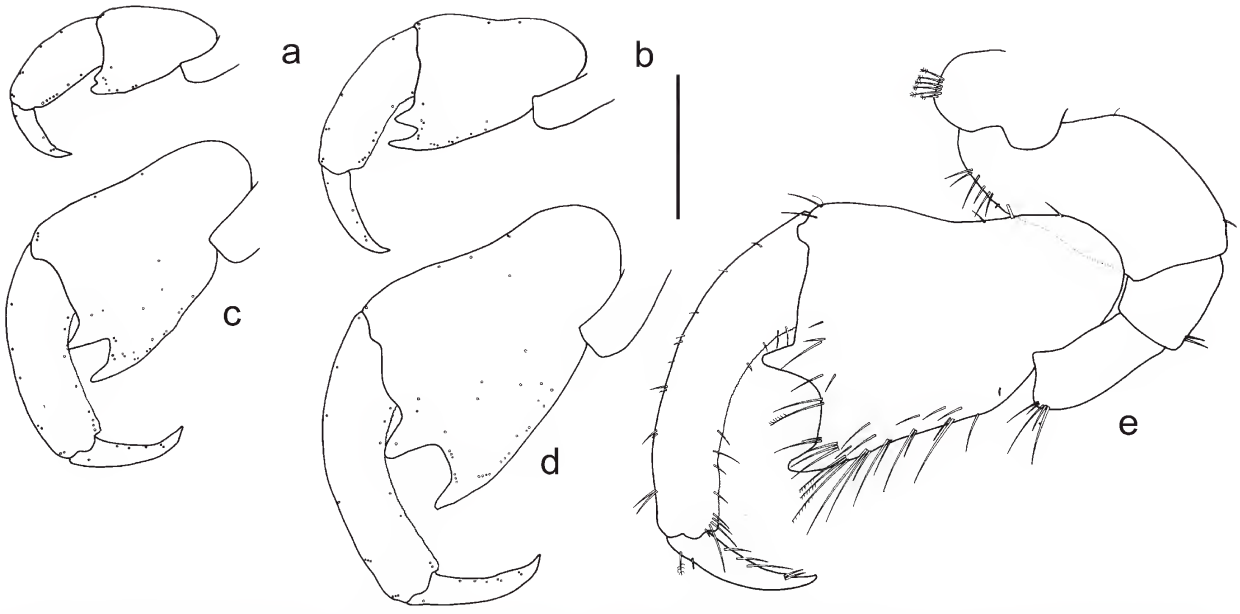


Figure 15. *Kapalana michaelmas* sp. nov., holotype, male "e", 10.3 mm, AM P.75528, Paratype, male "a", 5.7 mm, AM P.75530; paratype, male "b", 6.5 mm, AM P.75532; paratype, male "c", 7.5 mm, AM P.75533; paratype, male "d", 8.9 mm, AM P.75534; Michaelmas Island, King George Sound, Western Australia, Australia. Gnathopod 2 males "a", "b", "c", "d" insertion points of setae are indicated by small circles. Scale represents 0.1 mm.

Type locality. East of Port Jackson, New South Wales, Australia (33°52'S 151°23'E).

Etymology. Named for T.R.R. Stebbing, who first illustrated this species.

Description. Based on holotype male, 8.9 mm, AM P.51210.

Head. Rostrum long, length 0.3 × head, evenly tapered, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, ventral margin sloping, posterior margin sloping. *Antenna 1* long, length 0.6 × body length; peduncle with scales; peduncular article 1 shorter than article 3, length 0.6 × peduncular article 3, not produced anterodistally and anteromedially, with strong acute projection along posterior margin, posterodistal corner produced; peduncular article 2 anterodistal corner without distal projection; flagellum 9-articulate; article 1 long. *Antenna 2* length 1.1 × antenna 1; flagellum 7-articulate.

Epistome and upper lip fused, produced, broad base, apically acute.

Pereon. *Pereonite 1* with lateral keel, without sternal keel. *Pereonites 2–3* without sternal keel. *Pereonite 5* length 1.8 × depth.

Gnathopod 1 simple; coxa fused to pereonite 1, without anteroventral lobe; basis length 2.2 × depth; carpus very broad, length 2.2 × depth with setose posterior lobe, propodus palm extremely acute. *Gnathopod 2* carpochelate; coxa fused to pereonite 2, length 1.3 × depth, without anteroventral lobe or cusp; basis long, slender, length 3 × breadth, basis without anteroproximal group of long slender setae, basis without anteroproximal bulge; carpus very long, length 1.9 × breadth, slender, palm straight, anterodistal tooth small, located near articulation with propodus, posterodistal tooth poorly defined; propodus slender, slightly curved, length 5.5 × width, with proximal tooth on posterior margin, posterodistal corner minutely rugose with 1 tooth; dactylus length 0.5 × propodus.

Pereopod 3 coxa not fused to pereonite 3, without anteroventral lobe, length 1.7 × depth; basis, length 2.4 × breadth, with proximal, subquadrate anterodorsal corner, with plumose setal group and simple setae along anterior margin, without denticles along anterior margin; ischium long, length 3.9 × breadth; merus length 1.1 × breadth; short; without ridges. *Pereopod 4* coxa not fused to pereonite 4, length 2.3 × depth, with anterior lobe separated from an anteroventral lobe; basis length 1.8 × breadth, with plumose setae along entire anterior margin; ischium long, length 2.5 × breadth. *Pereopod 5* coxa, length 1.5 × depth, with patches of small setae, with setae along ventral margin; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 1 simple seta; propodus with 2 setae along posterior margin; dactylus short, uncinate with 1 accessory hook. *Pereopod 6* coxa with setal fringe ventrally, with patch of small setae near posterior margin; basis with patch of small setae near anterior margin; merus length 2.2 × breadth; dactylus short, uncinate, with 1 accessory hook. *Pereopod 7* coxa with posterodorsal lobe, with patch of small setae; merus length 2.5 × breadth; dactylus short, uncinate, with 1 accessory hook.

Pleon. *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 7-articulate; outer ramus 4-articulate, article 1 with straight medial margin. *Pleopod 2* inner ramus reduced, 1-articulate; outer ramus, broad, 1-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. *Uropod 1* biramous; peduncle length 1.4 × outer ramus; rami with distoventral fan of robust setae; outer ramus with lateral row of denticles, without medial setae, with 8 lateral setae, with large apical robust seta and smaller slender setae; inner

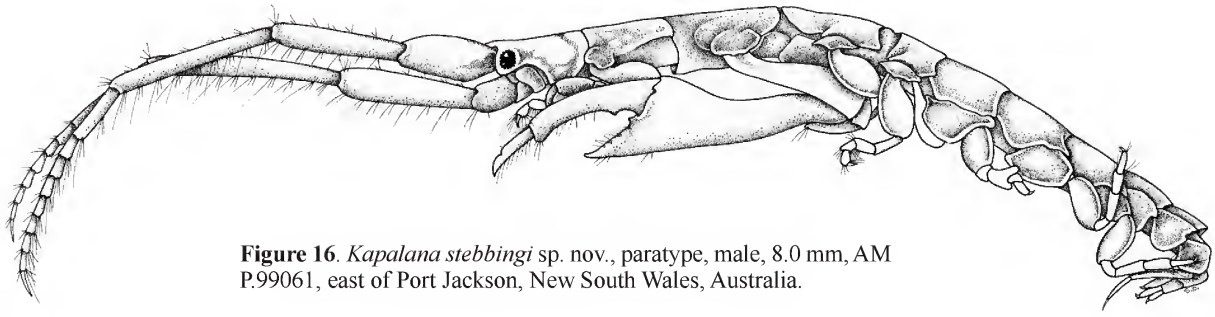


Figure 16. *Kapalana stebbingi* sp. nov., paratype, male, 8.0 mm, AM P.99061, east of Port Jackson, New South Wales, Australia.

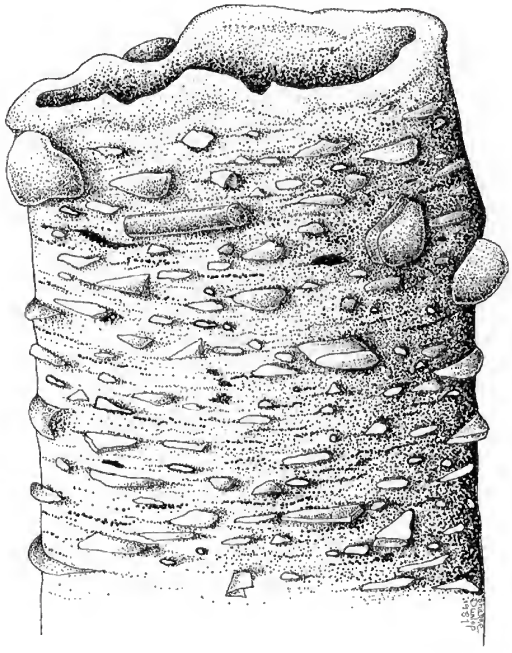
ramus, length 0.6 × outer ramus, without medial setae, with 4 lateral setae. *Uropod 2* uniramous, peduncle, length 2.8 × breadth, 4.4 × length of ramus; ramus small with 4 denticles and 1 slender apical seta. *Uropod 3* uniramous, peduncle length 1.8 × breadth; ramus with 2 curved hooks. *Telson* length 0.5 × breadth, moderately cleft (54 %), each lobe with 20–23 anteriorly directed hooks in 2 rows.

Female (sexually dimorphic characters). Based on paratype female, 6.4 mm, AM P.51211. *Antenna 1* flagellum 6-articulate. *Pereonite 1* without lateral keel. *Gnathopod 1* coxa not fused to pereonite 1, coxa, length 1.6 × depth; carpus broad, length equal to depth with setose posterior lobe. *Gnathopod 2* simple; coxa not fused to pereonite 2, length 1.6 × depth; basis short, broad, length 1.8 × breadth, carpus long, length 1.6 × breadth. *Pereopod 5* coxa, length 1.5 × depth. *Oostegites* from gnathopod 2 to pereopod 5.

Tube. Encrusted with sand grains and pieces of shell. Tubes of juveniles attached in a ring, circling the tube of adult female.

Habitat. Sublittoral and continental shelf (71–200 m depth).

Remarks. The shape of gnathopod 2 basis, propodus and carpus changes as males grow, with the propodus becoming slender and the basis carpus becoming much longer than wide in males larger than 7 mm. In males less than 5 mm



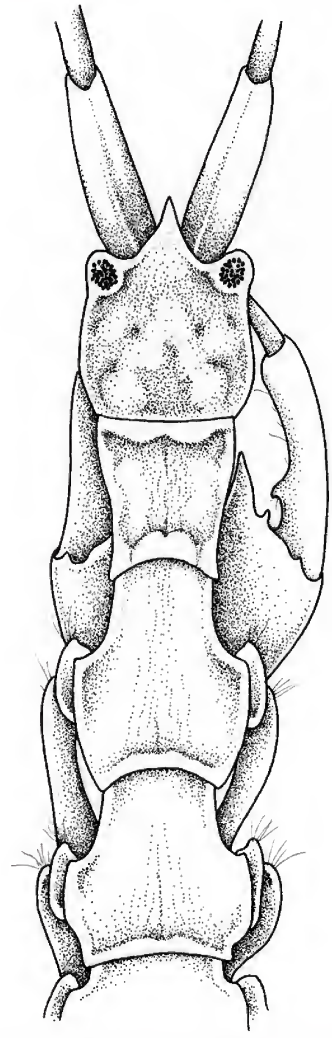


Figure 17. *Kapalana stebbingi* sp. nov., left, tube, AM P.2528, 9–12 km off Cape Three Points, New South Wales, Australia, (tube diameter = 1 mm); right, Paratype, male, 8.0 mm, AM P.99061, dorsal view of head and pereonites 1–3, east of Port Jackson, New South Wales, Australia.

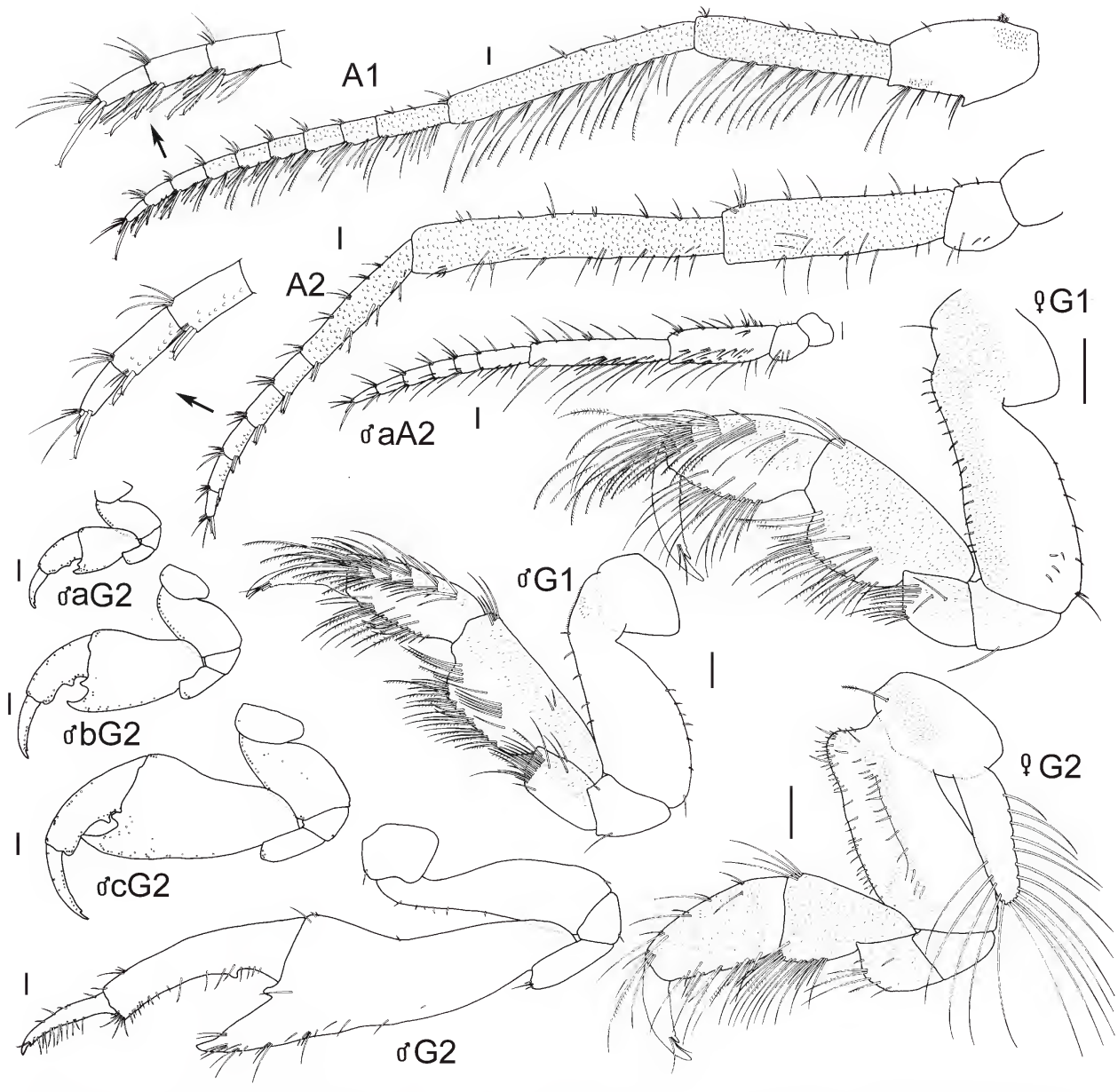


Figure 18. *Kapalana stebbingi* sp. nov., holotype, male, 8.9 mm, AM P.51210; paratype, male "a", 4.9 mm, AM P.99060; paratype, male "b", 5.7 mm, AM P.99059; paratype, male "c", 6.5 mm, AM P.99058; paratype, female, 6.4 mm, AM P.51211; east of Port Jackson, New South Wales, Australia. Gnathopod 2 males "a", "b", "c" insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

gnathopod 2 is subchelate. The proximal tooth on posterior margin is not prominent in males smaller than 5 mm. The carpus posterior margin is excavate in males 5.5 to 7 mm.

Kapalana stebbingi is the only species in the species group with antenna 1 peduncular article 1 with a strong subacute projection along the posterior margin, gnathopod 1 simple, the dactylus of pereopods 5–7 bearing 1 accessory hook, gnathopod 2 with a very long and slender carpus, the posterior margin of the propodus bearing a proximal tooth and a straight palm (all other species have an excavate palm).

Distribution. Australia. *New South Wales*: off Cape Three Points; off Botany Bay (Stebbing, 1910); east of Port Jackson; east of Long Reef; off Broken Bay. *Victoria*: south of Point Hicks.

Kapalana wadei sp. nov.

Figs 20–24

Holotype, male, 10.9 mm, AM P.78347, just beyond beach flats, off Bagnalls Beach, Port Stephens, New South Wales, Australia (32°43'17"S 152°07'17"E), benthic sledge, W. F. Ponder & S. J. Hall, 25 October 1980, NSW 191. **Paratypes**: 11 males, 2 females, 3 juveniles, AM P.78348; 1 male, AM P.78349; 1 male, 8.3 mm, AM P.78350; 1 male, 11.2 mm, AM P.78351; 1 female, 9.3 mm, AM P.78352; 1 male, 15.5 mm, AM P.78353; all with same data as holotype. Many specimens, AM P.78354, northern cove of Boondelbah Island, Port Stephens, New South Wales, Australia, (32°42'17"S 152°13'28"E), red algae and *Kapalana* tubes,

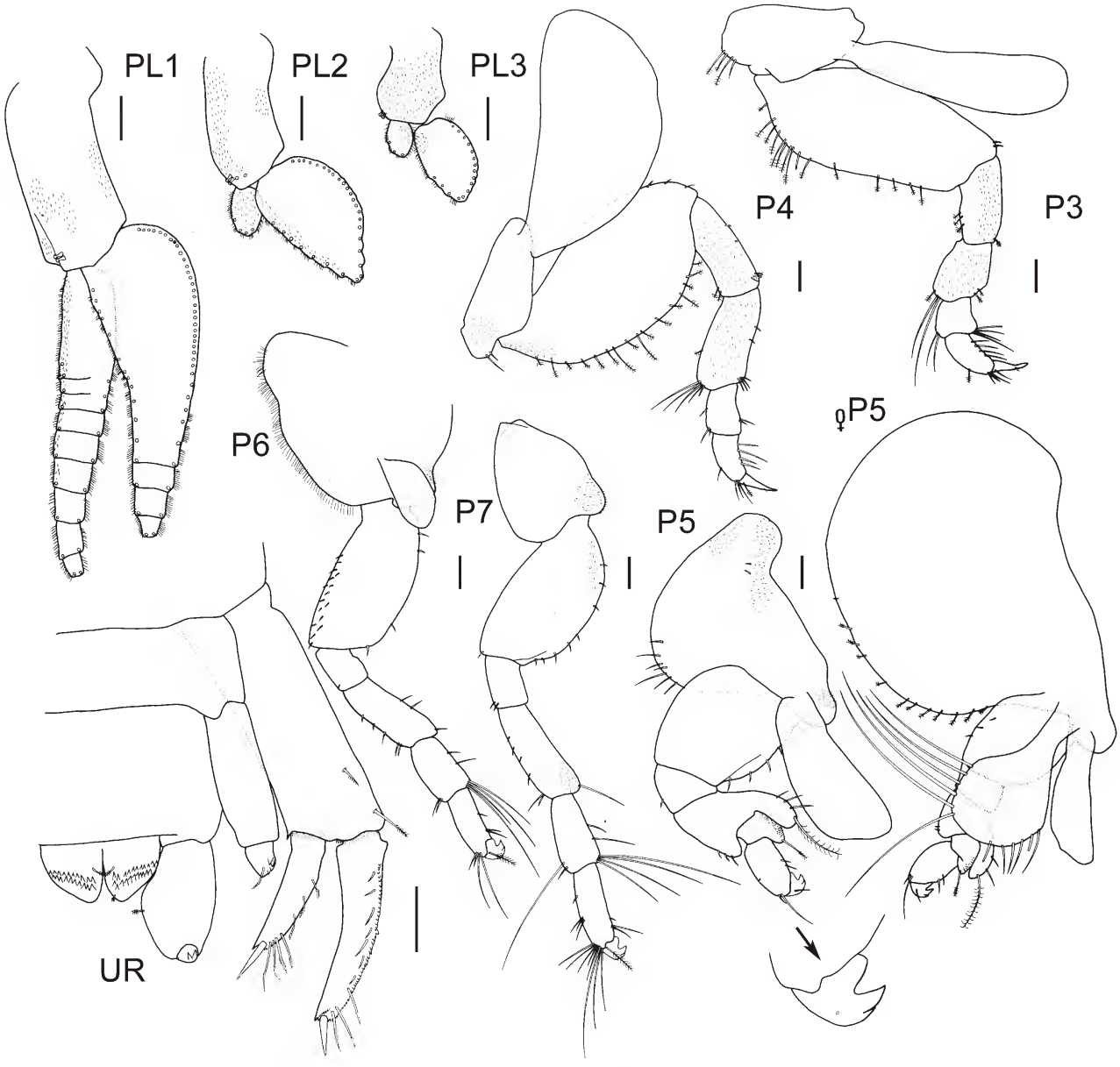


Figure 19. *Kapalana stebbingi* sp. nov., holotype, male, 8.9 mm, AM P.51210; paratype, female, 6.4 mm, AM P.51211; east of Port Jackson, New South Wales, Australia. Pleopods 1–3 insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

hand collected on scuba, 17.1 m, P. B. Berents, 28 May 1998, NSW 1405; many specimens, AM P.78355, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia (32°42'07"S 152°14'16"E), *Kapalana* tubes on large rocks, hand collected on scuba, 21.7 m, P. B. Berents, 30 May 1998, NSW 1454.

Additional material examined. 8 specimens, AM P.78356, Port Kembla, New South Wales, Australia, (34°29'S 150°55'E), low lying reef, 18 m, J. E. Watson; 4 specimens, AM P.78357, Jibbon Head, New South Wales, Australia, (34°04'S 151°10'E), on weed on reef, 23 m, J.E. Watson; 1 female, AM P.78358, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia (32°42'07"S 152°14'16"E), brown-purple multi-siphoned low sponge in sediment and attached to rock, hand collected on scuba, 21.8 m, S. J. Keable, 30 May 1998, NSW 1443; 1 female, AM P.78359, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia, (32°42'07"S 152°14'16"E), orange finger sponge from rock, hand collected on scuba, 21.6 m, S. J. Keable, 30 May 1998, NSW 1444; several specimens, AM P.78360, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia, (32°42'07"S 152°14'16"E), on lacy bryozoan cf. *Triphyllozoon* sp. on boulder, hand collected on scuba, 21.6 m, A. Murray, 30 May 1998, NSW 1446; 2 specimens, AM P.78361, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia (32°42'07"S 152°14'16"E), on orange feathery bryozoan, hand collected on scuba, 20.1 m, A. Murray, 30 May 1998, NSW 1453; 2 females, AM P.78362, north-west side of Little Island, east of Port Stephens entrance, New South Wales, Australia (32°42'07"S 152°14'16"E), on gelatinous ascidians on rocks, hand collected on scuba, 21.6 m, A. Murray, 30 May 1998, NSW 1455; 1 ovigerous female, AM P.78363,

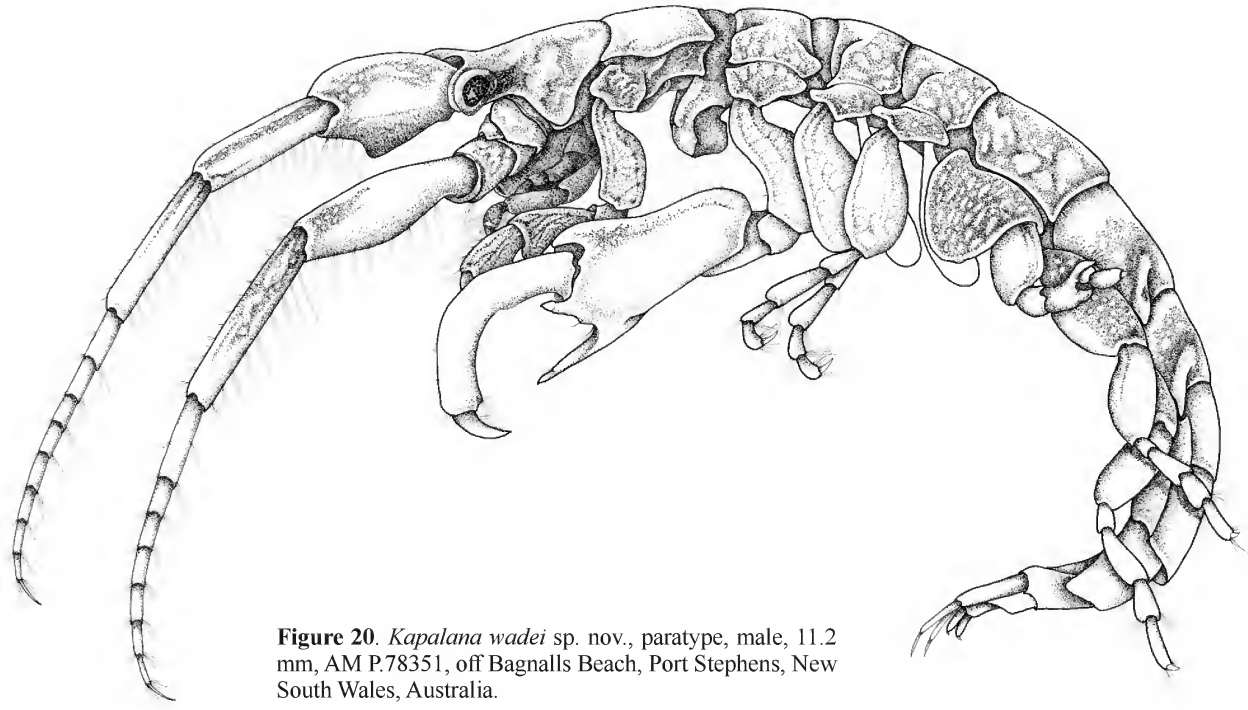


Figure 20. *Kapalana wadei* sp. nov., paratype, male, 11.2 mm, AM P.78351, off Bagnalls Beach, Port Stephens, New South Wales, Australia.

east of Red Head, New South Wales, Australia, (32°03'17"S 152°33'14"E), encrusted rock surface with sediment and worm tubes, airlift, 12.3 m, P. B. Berents, R. T. Johnson, S. J. Keable, A. Murray & R. T. Springthorpe on RV *Baragula*, 22 March 2003, NSW 2265; 2 males, AM P.78588, Jolong Reef, approximately 700 metres north east of Cape Banks, New South Wales, Australia, (33°59'47"S 151°15'13"E), turfing algae, hand collected on scuba, 21 m, A. Murray on RV *Baragula*, 10 November 2008, MI NSW 3369; many specimens, AM P.75506, Park Beach Bommie, east of Coffs Harbour, New South Wales, Australia (30°17'42"S 153°12'E), green alga *Halimeda* sp., hand collected on scuba, R. T. Springthorpe on RV *Baragula*, 3 May 2005, NSW 2828; 1 specimen, AM P.73743, east of Red Head, New South Wales, Australia (32°03'17"S 152°33'14"E), small sandy tubes from rock, hand collected on scuba, 12 m, Australian Museum Party, RV *Baragula*, 22 March 2003, NSW 2246; 1 male, AM P.74098, northern cove of Boondelbah Island, Port Stephens, New South Wales, Australia (32°42'17"S 152°13'28"E), red algae and *Kapalana* tubes, hand collected on scuba, 17.1 m, P. B. Berents, 28 May 1998, NSW 1405; many specimens, AM P.99316, Home Bommie, south east of Sullivan's Reef, east of Ulladulla, New South Wales, Australia (35°21'40"S 150°29'36"E), brown and red algae and lacy bryozoans scrapings on rock wall, by hand on scuba, 21.5 m, A. Murray on RV *Baragula*, 13 May 2013, MI NSW 4201.

Type locality. Off Bagnalls Beach, Port Stephens, New South Wales, Australia (32°43'17"S 152°07'17"E).

Etymology. Named for Dr Denis Wade AM, Former Foundation Professor, Clinical Pharmacology at The University of New South Wales.

Description. Based on holotype, male, 10.9 mm, AM P.78347.

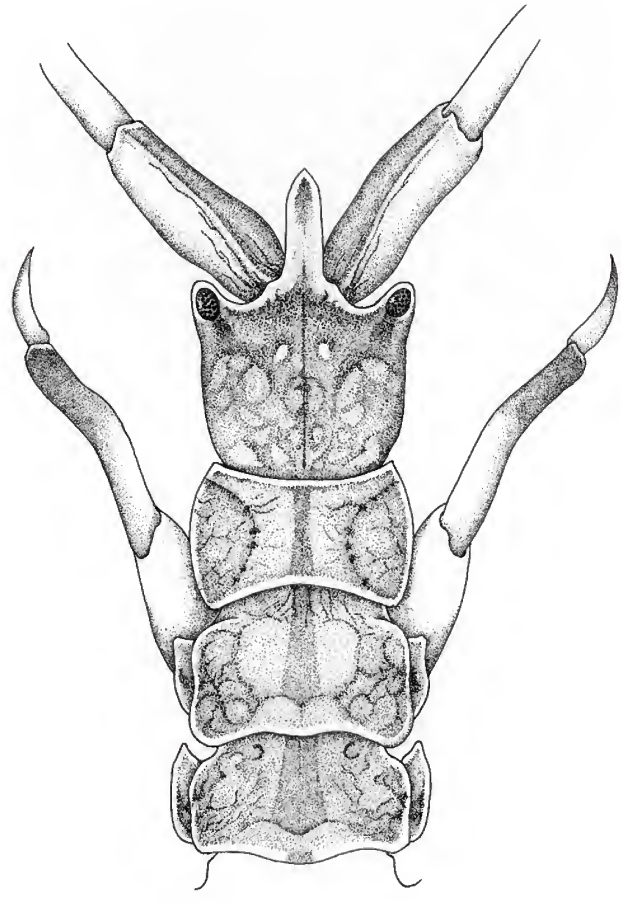


Figure 21. *Kapalana wadei* sp. nov., paratype, male, 11.2 mm, AM P.78351, dorsal view of head and pereonites 1–3, off Bagnalls Beach, Port Stephens, New South Wales, Australia.

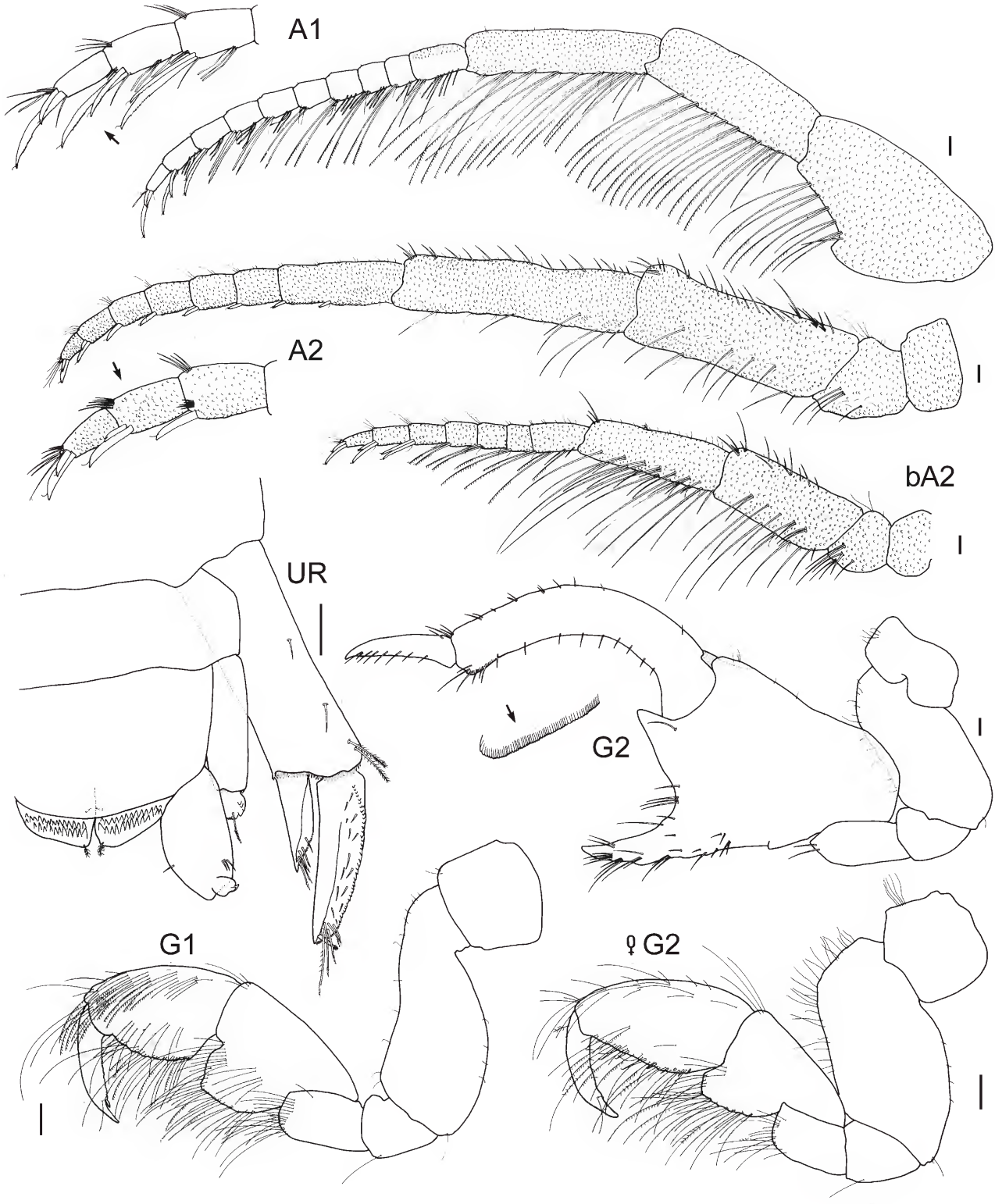


Figure 22. *Kapalana wadei* sp. nov., holotype, male, 10.9 mm, AM P.78347; paratype male "b", 8.3 mm, AM P.78350; paratype, female, 9.3 mm, AM P.78352; off Bagnalls Beach, Port Stephens, New South Wales, Australia. Scales represent 0.1 mm.

Head. Rostrum very long, length 0.6 × head, forming a basal shoulder, apically acute; lateral cephalic lobe with ventral corner rounded, subocular margin deeply recessed, reaching beyond eye, anteroventral corner rounded, ventral margin sloping, posterior margin sloping. *Antenna 1* long, length 0.5 × body length; peduncle with scales; peduncular article 1 subequal to article 3, length 1.1 ×peduncular article 3, not produced anterodistally and anteromedially, with strong sub-quadrate projection along posterior margin, posterodistal corner not produced; peduncular article 2 anterodistal corner with distal projection flagellum 10-articulate; article 1 short. *Antenna 2* length 1.1 × antenna 1; flagellum 7-articulate.

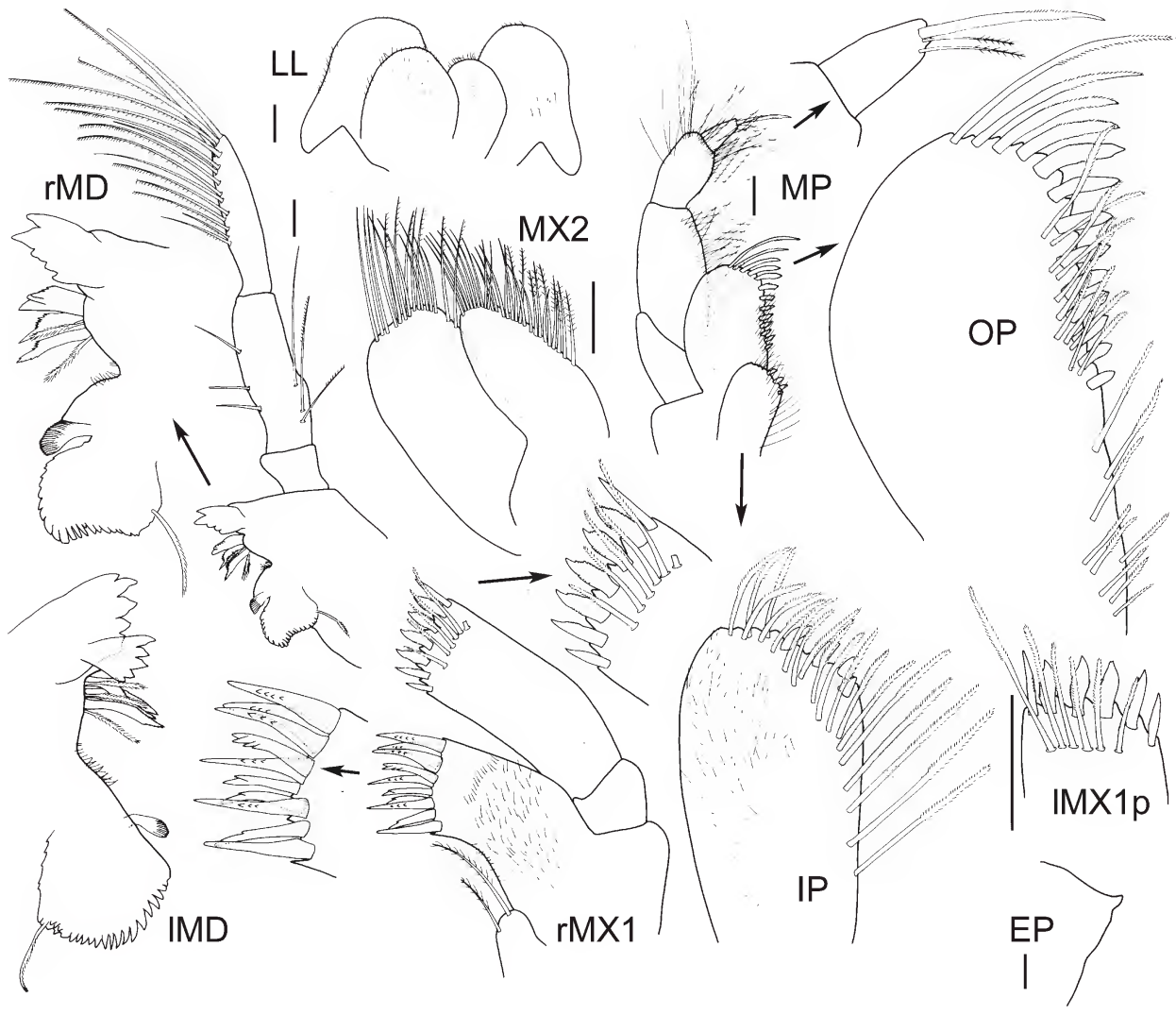


Figure 23. *Kapalana wadei* sp. nov., holotype, male, 10.9 mm, AM P.78347; off Bagnalls Beach, Port Stephens, New South Wales, Australia. Scales represent 0.1 mm.

Epistome and upper lip fused, produced, broad base, apically acute. *Mandible,* palp article 2 long and slender, 2.5 × as long as broad, subequal in length to article 3; palp article 3 slender, blade-like, length 5.2 × breadth.

Pereon. *Pereonite 1* with lateral keel and sternal keel. *Pereonites 2–3* without sternal keel. *Pereonite 5* length 1.5 × depth.

Gnathopod 1 subchelate; coxa fused to pereonite 1, without anteroventral lobe; basis length 2.2 × depth; carpus broad, length 1.4 × depth with setose posterior lobe, propodus palm acute, robust setae absent. *Gnathopod 2* carpochelate; coxa not fused to pereonite 2, length 1.9 × depth, without anteroventral lobe or cusp; basis short, broad, length 1.5 × breadth; carpus long, length 1.1 × breadth, broad, palm shallowly excavate, anterodistal tooth large, located near articulation with propodus, posterodistal tooth well defined, long, length 2.1 × width; propodus slender, strongly curved, length 5.1 × width, without tooth on posterior margin, posterodistal corner rugose, without spines; dactylus length 0.4 × propodus.

Pereopod 3 coxa not fused to pereonite 3, without anteroventral lobe, length 1.8 × depth; basis, length 2.3 × breadth, with proximal rounded anterodorsal corner, with plumose setal group and simple setae along anterior margin, without denticles along anterior margin; length 1.9 × breadth; merus length 1.2 × breadth, short, without ridges. *Pereopod 4* coxa not fused to pereonite 4, length 2.3 × depth, with anteroventral lobe; basis, length 2 × breadth, with simple setal group midway along anterior margin; ischium long, length 2.6 × breadth; merus long, length 1.4 × breadth. *Pereopod 5* coxa, length 0.8 × depth, without patches of small setae, with setae along ventral margin; merus with anterior lobe extending beyond anterior margin of carpus, posterior lobe with 6 plumose setae; propodus with 5 setae along posterior margin; dactylus short, uncinate with 2 accessory hooks. *Pereopod 6* coxa with setal fringe ventrally, without patches of small setae near margins; basis with patch of small setae near anterior margin; dactylus short, uncinate, with 2 accessory hooks. *Pereopod 7* coxa without posterodorsal lobe, without patch of small setae; dactylus short, uncinate, with 2 accessory hooks.

Pleon. *Pleopods 1–3* biramous, decreasing in size anteroposteriorly. *Pleopod 1* inner ramus 10-articulate; outer ramus 9-articulate, article 1 evenly swollen. *Pleopod 2* inner

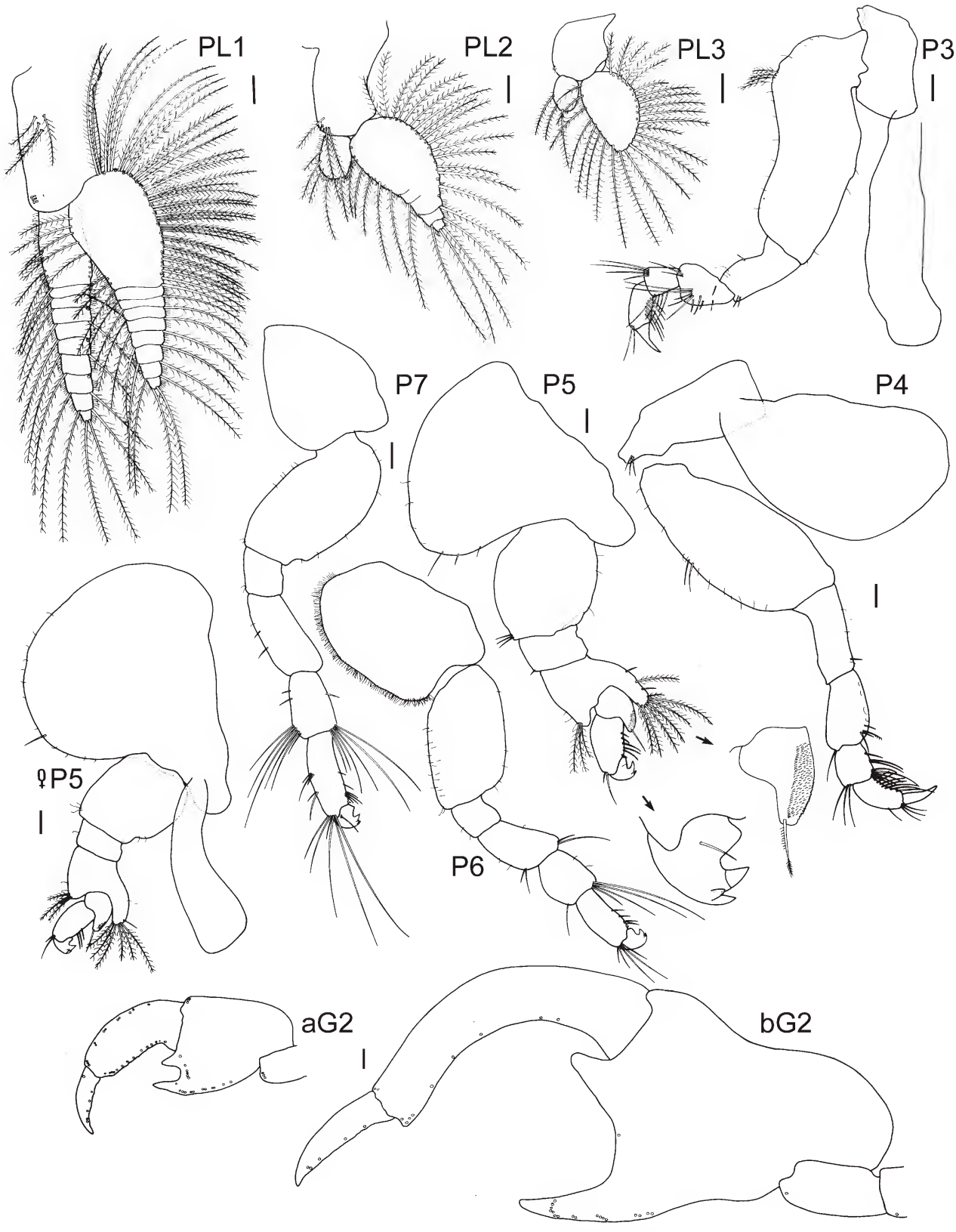


Figure 24. *Kapalana wadei* sp. nov., holotype, male, 10.9 mm, AM P.78347; paratype male "a", 8.3 mm, AM P.78350; paratype, male "b", 15.5 mm, AM P.78353; paratype, female, 9.3 mm, AM P.78352; off Bagnalls Beach, Port Stephens, New South Wales, Australia. Gnathopod 2 insertion points of setae are indicated by small circles. Scales represent 0.1 mm.

Key to species of *Kapalana* g. nov.

1 Rostrum very long, more than half as long as head ..... *Kapalana wadei* sp.nov.
—— Rostrum less than half as long as head 2

2 Gnathopod 2 propodus with tooth on posterior margin ..... *Kapalana stebbingi* sp. nov.
—— Gnathopod 2 propodus without tooth on posterior margin 3

3 Gnathopod 2 carpus with row of small spines on posterior margin ..... *Kapalana amelga* sp. nov.
—— Gnathopod 2 carpus without row of small spines on posterior margin 4

4 Antenna 1 peduncular article 2 with medial triangular projection on posterodistal corner ..... *Kapalana maia* sp. nov.
—— Antenna 1 peduncular article 2 without medial triangular projection on posterodistal corner 5

5 Rostrum evenly tapered ..... *Kapalana durraween* sp. nov.
—— Rostrum forming a basal shoulder 6

6 Pereopod 5 merus posterior lobe with 2 plumose setae ..... *Kapalana michaelmas* sp. nov.
—— Pereopod 5 merus posterior lobe with 5 plumose setae ..... *Kapalana kimbla* sp. nov.

ramus reduced, 1-articulate; outer ramus broad, 3-articulate. *Pleopod 3* inner ramus reduced, 1-articulate; outer ramus broad, 1-articulate. *Uropod 1* biramous; outer ramus with lateral row of denticles, without medial setae, with 13 lateral setae, with large apical robust seta and smaller slender setae; inner ramus, length 0.7 × outer ramus, without medial setae, with 1 lateral seta, without large apical robust seta. *Uropod 2* uniramous, peduncle, length 2.8 × breadth, 4.2 × length of ramus; ramus small with 6 denticles and 1 slender apical seta. *Uropod 3* uniramous, peduncle length 1.7 × breadth; ramus with 2 curved hooks. *Telson* length 0.5 × breadth, moderately cleft (31 %), each lobe with 26–27 anteriorly directed hooks, in 2 rows.

Female (sexually dimorphic characters). Based on paratype female, 9.3 mm, AM P.78352. *Antenna 1* flagellum 8-articulate. *Antenna 2* flagellum 10-articulate.*Pereonite 1* without lateral keel, without sternal keel. *Gnathopod 1* coxa not fused to pereonite 1, length 1.2 × depth; carpus length 0.6 × depth with setose posterior lobe. *Gnathopod 2* simple; coxa, length equal to depth; carpus length 1.3 × breadth. *Pereopod 5* coxa, length 1.3 × depth. *Oostegites* from gnathopod 2 to pereopod 5.

Tube. Encrusted with sand grains and pieces of shell; tubes of juveniles attached in a ring, circling the tube of adult female.

Habitat. Sublittoral (12–22 m depth).

Remarks. The shape of gnathopod 2 propodus and carpus changes as males grow, with the propodus becoming curved and slender. In males smaller than 8.5 mm the carpus posterior margin is more deeply excavate than in larger males.

Kapalana wadei is the only species with very long rostrum (greater than 50% the length of the head). The rostrum has a basal shoulder, which is a character shared with both *K. michaelmas* and *K. kimbla*. It shares with *K. durraween*, *K. michaelmas* and *K. maia* a lack of apical robust seta on the inner ramus of uropod 1.

Distribution. Australia. *New South Wales*: Coffs Harbour to Ulladulla.

Discussion

Within the Cerapodini the unusual process by which juveniles attach their tubes to adult females appears to be unique to *Kapalana*. Extended parental care has been reported in amphipods and may take the form of juveniles remaining in the female marsupium (Shillaker & Moore, 1987; Kobayashi *et al*., 2002; Thiel, 2003), juveniles on the female body (Aoki, 1999) and juveniles sharing the parental dwelling (Thiel, 2000b, 2003). Myers (1971) reported that the young of another corophiid, *Microdeutopus gryllotalpa* Costa, 1853, constructed tubes on the inside and outside of the parental tube.

Thiel (2003) suggests that the benefits of parental care include provision of a microhabitat for juveniles, assistance with feeding or grooming of juveniles and active defence or guarding. Thiel (1999) noted that when females carry their offspring, a second brood is not usually produced while carrying one brood, but in examples when the female guards the juveniles, a second brood may be produced while caring for the first, as seen in *Kapalana* (Fig. 4).

Although nothing is known about possible interactions between parent and juveniles in *Kapalana*, the fact that up to two generations of juveniles may attach to the mother tube indicates at least passive protection (Shillaker & Moore, 1987; Thiel, 1999, 2000a). It is not known how long juveniles of *Kapalana* remain in the tube attached to the female tube. Thiel (1999) found the duration of extended parental care in tube dwelling species to be variable but may be long lasting (exceeding 20 days).

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